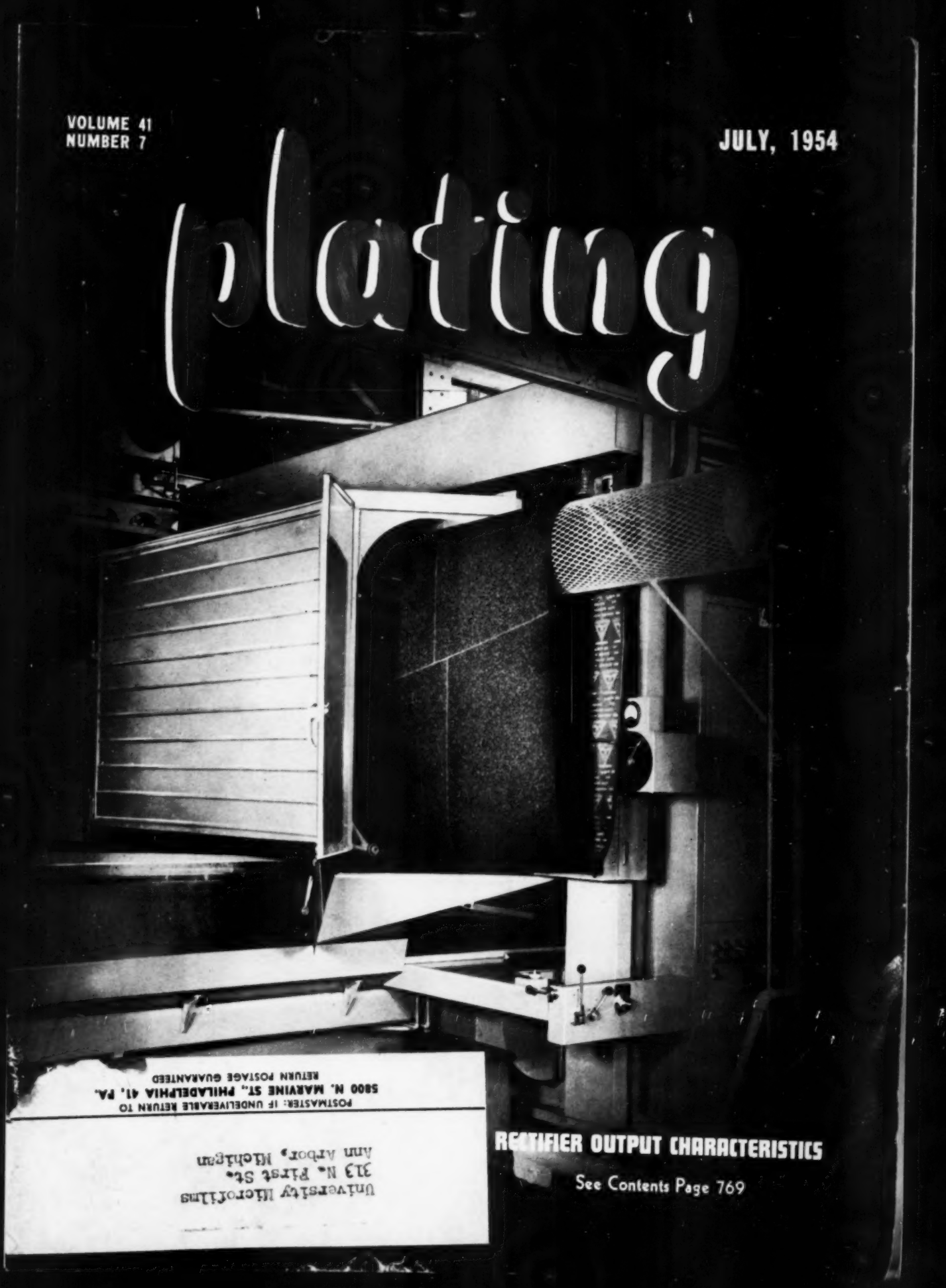
VOLUME 41
NUMBER 7

JULY, 1954

# plating



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## RECTIFIER OUTPUT CHARACTERISTICS

See Contents Page 769

# A Superior ANODIC ELECTROCLEANER

*For zinc base Die-Castings*

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For many years an outstanding Anodic Cleaner for zinc base now further improved.

- Eliminates Dry-off Staining
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**At Enthone our sole aims are the development of better methods for the improvement of metal finishing and the reduction of finishing costs. These we have accomplished in the field of corrosion prevention. Our research chemists and engineers are responsible for the following outstanding metal finishing products for the prevention of costly corrosion:—**

**ENTHOX:** Puts iridescent, gold-colored chromate coating on zinc and cadmium. An excellent base for organic finishes. Highly resistant to corrosion; withstands salt spray from 100 to over 1000 hours.

**COMPOUND 39:** A one-operation phosphating and cleaning compound for steel and zinc. Fine grained, highly adherent phosphate coat is ideal base for organic finishes. Gives high bond strength.

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Photo courtesy U. S. Metals Coatings Co., Inc., Elizabeth, N. J.

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# In This Issue

**Voltage and Current Fluctuations in the Output of Plating Rectifiers** by V. L. Richards is a paper that presents data on voltage and current fluctuations in the output of selenium rectifiers. The author points out that normal metering units are so designed that they do not show fluctuations that may occur. In order to get a better representation of such variations an oscilloscope was used to study rapidly changing values. Full story starts on page 773.

**Analytical Determination of Trace Constituents in Metal Finishing Effluents. V. The Colorimetric Determination of Nickel in Effluents** by D. G. Gardner, E. J. Serfass and R. F. Muraca. The method makes use of a treatment with hot, concentrated acids to remove organic matter and an extraction of the nickel content of the sample as the dimethyglyoxime complex with chloroform. The intensity of the color of the nickel dimethylglyoxime complex is measured with a colorimeter after its extraction from the chloroform solution. Full text begins on page 782.

**Plating Applications in the Television Field** by Leonard P. Fox. This article describes some unusual plating applications in the production of electron tubes for the television field. Applications described are used primarily for functional rather than decorative purposes. Described is the plating of fine mesh screens for use in television camera tubes. Full text begins on page 785.

**AES Research Project No. 4—Effect of Surface Finishing of Nonferrous Base Metals on the Protective Value of Plated Coatings** by George J. Kahan, W. W. Macchia and J. M. Fairbank. This is the concluding part of the report that began in last month's issue. This section covers the work on zinc die castings. Report begins on page 789.

**Fourth International Conference on Electrodeposition Was a Highly Successful Meeting** by Walter R. Meyer is an eye-witness report of the recently conducted international meeting at London. Details are given on the educational and social high lights of the affair. Those articles not abstracted in the Article Abstract section of this journal are reviewed in the report. The full story starts on page 793.

**For page numbers, see Table of Contents, page 769**

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# Industry News

**Cowles Holds Sales Clinic.** The metal cleaner department of Cowles Chemical Co., Cleveland, held its eighth annual sales conference at the company's general offices last month.

Earl Clark, department manager, led discussions on old and new products and outlined the company's future sales aims. He was aided by Carl Clabaugh, assistant department manager, and Dr. John B. Davidson, Cowles' director of research.

**Graver Water Conditioning Opens Western European Office.** Graver Water Conditioning Co. announces the opening of a western European office under the direction of Jorgen Berring, European sales engineer. Graver's new office is arranged to handle the sale, installation and servicing of all types of industrial and municipal water treatment and industrial waste treatment equipment throughout the Scandinavian countries and western Europe. Berring will be located in Copenhagen, K., Denmark.

*Cowles technical men in attendance were (front): George Parisho (St. Louis), Clay Sayers (Cincinnati), George Woleben (Upper New York State), President W. F. Huntley, Secretary-Treasurer W. M. Clossey, Earl Clark, Carl Clabaugh. (Rear) Gene Brost (Syracuse Laboratory), Charles Churchill (Cleveland), Dr. John Davidson (Syracuse Laboratory), Gene Rechlicz (Milwaukee), Fred Hitchcock (Detroit), John Cloonan (Boston), Gene Garman (Chicago), Clyde Lowe (Cleveland), Luther Fuelling (Cleveland) and Jack Dobson (New York)*


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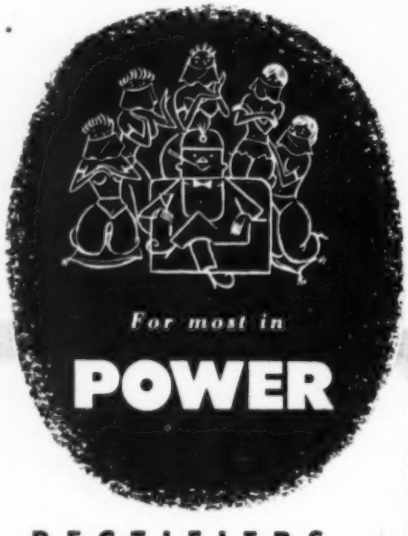


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**SEL-REX places no limitation on engineering to achieve the finest DC power plant . . . nor compromise in the choice of component parts to "bring the cost down." True, such a policy may reflect a slightly higher initial cost . . . but in the long run a SEL-REX UNIT is the most economical. There are no moving parts to wear out — no maintenance expense, no loss of production.**

**SEL-REX RECTIFIERS available for every requirement from 25 to 50,000 amperes including completely sealed water cooled and air cooled models.**

*Write for complete details.*

NEMA

**BART-MESSING CORPORATION**

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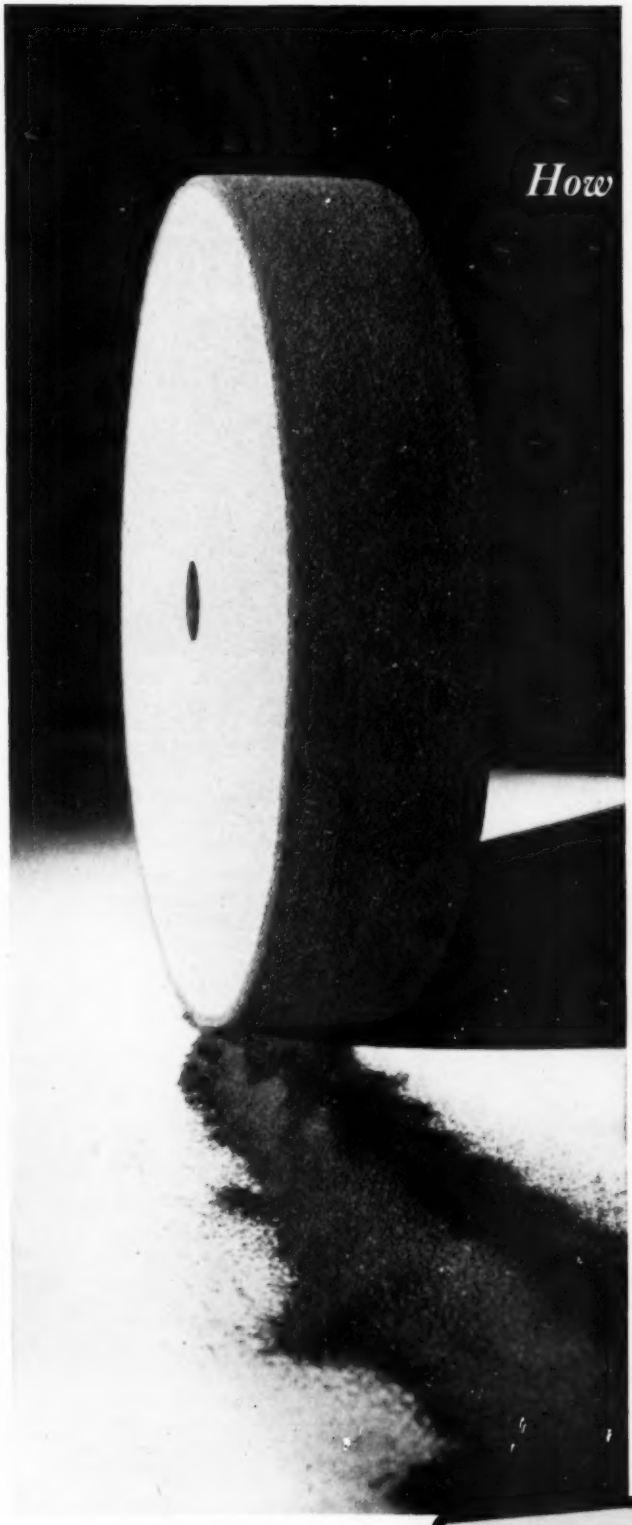
### Sustaining Memberships

The listing of sustaining members published in the July issue omitted the following three organizations: L. F. Grammes & Sons, Inc., Allentown, Pa.; Lea-Ronal, Inc., Long Island City, N. Y.; and Prime Plating Works, Inc., Brooklyn, N. Y. This oversight is regretted.

Since that listing was compiled, additional new members have subscribed to the AES Research Program. The new subscribers are:

**California Rack Co., South Gate, Calif.**
**Canadian General Electric Co., Ltd., Peterborough, Ontario**
**General Steel Wares, Ltd., Toronto, Ontario, Canada**
**Grand Steel Co., Clawson, Mich.**
**Oakman Plating Co., Van Dyke Mich.**
**Standard Nickel-Chromium Plating Co., Los Angeles, Calif.**
**Turco Products, Inc., Los Angeles, Calif.**
**United Chromium, Ltd., Toronto, Canada**
**Wildberg Brothers Smelting & Refining Co., Los Angeles, Calif.**



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- Its high capillarity, produced by special Norton processing, means easier wetting with the glue and assures stronger, faster cutting, longer lasting wheel heads.
- *And you can get* ALUNDUM *grain in exactly the grain shapes and surface treatments you need to add the product-improving, money-saving "Touch of Gold" to every step of polishing, with every type of wheel and on every metal.*

### *Watch your setting up temperatures!*

Cold wheels and cold abrasive grain jell the hot glue too rapidly, which reduces its adhesiveness and prevents sufficient pickup of grain, resulting in slow cutting, hot running wheel heads. To guard against this, pre-heat wheels and grain to between 100° and 120°F, so the glue solution can be applied at a temperature of 140°F. Also, hold the setting up room temperature around 80°F, use uniform pressure when rolling wheels in the grain trough, and make the whole procedure as fast as possible.

### *Further helpful information*

on every factor in the setting up process — including the selection of ALUNDUM grain, preparation of glue, use of cement, drying operations, wheel types, polishing different metals, etc. — is contained in the Norton booklet *Setting Up Metal Polishing Wheels and Belts.* Your Norton Distributor can supply it, and can make quick deliveries of ALUNDUM grain from complete stocks in key cities. Or write to NORTON COMPANY, Worcester 6, Mass. Distributors in all principal cities, listed under "Grinding Wheels" in your classified phone directory. *Export:* Norton Behr-Manning Overseas Incorporated, Worcester 6, Massachusetts. G-275

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These chromium plated door-knobs are on display at the Chandler Chemical Museum, Columbia University, New York.

The year 1924 marked a significant new development in metal finishing—a commercial process for Chromium Plating. The door knobs referred to above were the first objects so plated and were installed on the door of Dr. Fink's laboratory where they remained in service for many years.

The immediate demand for chromium plated metal which arose as a result of the new process added another important product to Mutual's list of chromium chemicals, namely, Chromic Acid. Today, the Mutual trade mark on Chromic Acid drums is known and respected wherever chromium plating is performed.

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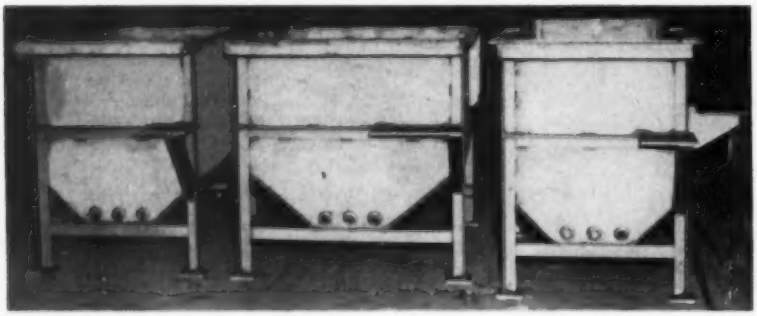

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## *Industry News*

**First Employee Retires Under H-VW-M's New Retirement Plan.** First employee to leave Hanson-Van Winkle-Munning Company under H-VW-M's new retirement plan is James J. Gormley of Matawan, who retired after 42 years with the company.

*Left to right: Donald Wier, H-VW-M plant superintendent; James J. Gormley, Louis M. Hague, H-VW-M president*

Louis M. Hague, H-VW-M president formally presented Gormley his first monthly retirement check.

Gormley was employed in the company's tin can shop, where he spent most of his working hours during the past 34 years. When he joined the company in 1912, he fired boilers at first, and then worked in the anode foundry.

**Weaver Engineering & Supply Company Expands.** Weaver Engineering and Supply Company, Inc., 718 W. Main St., Grand Prairie, Texas (Dallas), in a move to expand with industry in the Southwest, announces the purchase of an office and warehouse of 3,500 square foot area at the above address.

As distributors for Enthone, Inc., R. O. Hull and Co., Formax and Munray Products Co., they will maintain complete stocks of the products of these organizations to serve better the metal finishing industry in the Southwest.


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For a small job plating shop on Florida West Coast. Must understand control and operation of copper, nickel, chromium, brass and silver. Opportunity to share in profit of growing company.

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Reverse-current cleaning with Oakite Composition No. 90 gives you a superior job of removing oils, smuts and other films that interfere with good plate adhesion and eye appeal. This efficient, Oakite solution operates with long life and maximum economy.

**FOR CLEANING ZINC-BASE DIE CASTINGS**

Soak cleaning and final conditioning of polished zinc-base die castings in Oakite Composition No. 95 yields brighter plating. There's no anodic blackening under its evenly-controlled action. A free-rinsing solution, Oakite Composition No. 95 leaves no interfering residual film on castings.

**FOR CLEANING BRASS, COPPER**

Oakite Composition No. 191 thoroughly removes polishing compounds, other troublesome deposits. It provides a bright, tarnish-free finish. This solution has high conductivity, high tolerance for chromic acid drag-in, and exceptional free-rinsing properties.

"TANK-SIDE" SERVICE by OAKITE is available to all users of Oakite materials. The purpose of this personalized service is to provide you with a low-cost, trouble-free procedure for performing each of those critical cleaning operations. For the name of your nearest Oakite Technical Service Representative write Oakite Products, Inc., 40 Rector Street, New York 6, N. Y.

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## *Industry News*

In addition to distributing and warehousing these products, Weaver Engineering and Supply Co., Inc., will manufacture resin-bonded Fiberglas tanks, duct work and hoods, will line tanks with Munray cycloflex plastic lining, and will design, manufacture and coat plating racks with Munray plastisol rack coating.

**Metal Finishing Suppliers' Association Annual Golf Tournament.** The Metal Finishing Suppliers' Association will sponsor once again the annual golf tournament held during the American Electroplaters' Society Convention. The site of the tournament this year will be the Forest Hill Field Club in Bloomfield, N. J., on Thursday, July 15.

Specific information about transportation, tee-off times, and other arrangements can be obtained at headquarters during the convention or by contacting any of the members of the committee, John Gumm, Jim Clifford or Joe Duffy.

**Bart-Messing Corporation Opens New Plant.** Completion of a new building that will provide an additional 12,000 square feet of manufacturing space for Sel-Rex selenium rectifiers, has been announced by Bart-Messing Corp., Belleville, N. J.

The new building is the third structure erected by the company in the past 18 months, on a 6½-acre tract on Manchester Place, Newark, N. J. With the new plant, the associated companies, Bart Manufacturing Corp., Sel-Rex Precious Metals, Inc., and Bart Laboratories Co., Inc., now operate 7 plants in the Belleville-

Newark area for the manufacture of plating equipment and production of specialized types of industrial precision plating.

The new one-story structure, serviced by main lines of two major railroads, is planned ideally for expanded production. Manufacturing facilities are set up on assembly line basis, and include the most modern equipment and testing devices.

The main offices of Bart-Messing Corp., will be retained at the Belleville plant of the company.

**Glover Coating Co.-Allen Co. News.** Manson Glover has announced the acquisition of Glover Coating Co., Inc., by Ellis Allen Co., Woburn, Mass., manufacturers of rubber-covered rolls and molded rubber goods.

Glover

Glover continues as President of the company and John A. Chew, President of Ellis Allen Company, has become Treasurer of Glover Coating Co. Administrative offices of the two companies are at 5 Conn St., Woburn. Plant operations continue at Malden, Mass., under the direction of William W. Stasiowski.

**New Detrex Branch Office and Warehouse.** Confidence in the growth of the industrial West Coast was again reaffirmed as the Detrex Corp. of Detroit announced the completion of its new

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From this simple beginning...

## *The Remarkable Account of How a Basement Plating Shop Expanded to a Big Producer*

On Helen Avenue, in Detroit, stands an eloquent symbol of the remarkable improvements that take place in a plating plant when executive management makes the decision to *go automatic* . . . with Udylite.

Lee Silver Service, Inc. supplies precision plated parts to automotive and appliance companies, in quantities running into the millions. Production surpasses 80,000 precision plated parts daily . . . yet, consider . . .

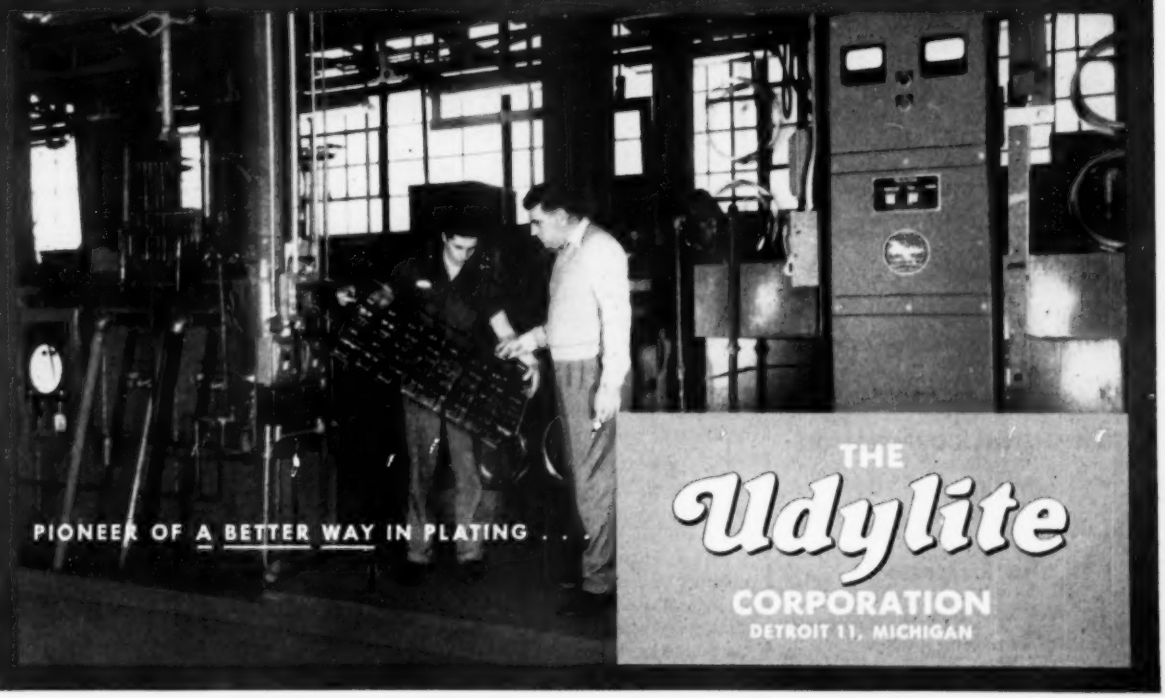
This business, started only 15 years ago, was once a two-man operation in a basement . . . so small that their first month's plating supplies were carried into the shop in one hand by the Udylite delivery man.

But the men behind Lee Silver Service, Inc. were sold on the great potential for a company specializing in gold and silver plating . . . and they knew their future would ultimately include the finest in automatic plating machines. When, in 1947, they landed the biggest order for silver and gold plating ever sold—supplying silvered cabinets and gold fittings for the anniversary model of a famous automatic washing machine—they knew the days of hand-delivered supplies were a thing of the past.

During this development Udylite and Lee Silver worked hand in hand. Today this company is 100% Udylite automatic. Sales have soared. Production has zoomed. Rejects have been cut to .4 of 1%. Yes, progress and growth have come . . . *automatically!*

If *you* are in the plating business to stay, it's inevitable that you, too, will come to Udylite automatic equipment eventually . . . why not look into it today . . . *now.*

. . . to this completely automatic plating plant—with Udylite equipment and technical guidance *all the way!*



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## *Industry News*

branch warehouse and office located in suburban Los Angeles.

Doubling the size of former facilities, the newly constructed branch serves as headquarters for a staff of 8 service and sales engineers.

**2nd NFMF Seminar.** The 2nd semi-annual management seminar of the National Federation of Metal Finishers will be held at the Sky Top Room of the Hotel Statler, New York City, on Tuesday, July 13, according to Philip Ranno, Imperial Plating Co., Brooklyn, N. Y., president of the job-shop platers' organization.

Two morning sessions and two afternoon sessions on management problems are scheduled for an estimated attendance of more than 200 owners and managers of job shop metal finishing establishments and supervisors of finishing departments in manufacturing plants. Admission to the all-day event is by invitation only. There is no registration fee.

Among the speakers and their topics are: Louis J. Donroe, Royal Plating & Polishing Co., Newark, N. J., "Managing a Job Shop Under Today's Conditions"; Ludwig Teller, attorney and member, N. Y. State legislature, "Specific Labor Relations Issues of the Plating Industry"; Kenneth Eaton, Associated Business Consultants, Chicago, Ill., "Building a Job Evaluation Program for the Metal Finishing Shop"; Silvio C. Taormina, Director, Platers' Technical Service, New York and Chicago, "A Look Into the Future of the Job Shop Plating Industry."

Also scheduled for Tuesday evening, July 13, is a dinner sponsored by the NFMF for industry members and their families.

Acting as host to the group is the Masters' Electro-Plating Association of New York. The MEPA, under the direction of committee chairman, John J. Forbath, Star Chromium Corp., N. Y., is presenting an illuminated exhibit showing various and unusual types of electroplated and allied finishes performed by member firms in the greater New York area. The exhibit, 35 feet in overall length, will be displayed among other exhibits on the mezzanine floor of the Hotel Statler, scene of the concurrent AES Convention.

The New York job shop association also is undertaking a series of plant tours whereby job shop owners from other cities will have the opportunity to witness the production facilities and layouts of member companies. The association, one of several affiliated with the NFMF, is developing these plans as another step in the direction of cooperative effort between job shop operators throughout the country.

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- COMFORT
- ECONOMY

*In Ply-Garb, modern developments in plastic are used to create clothing with amazing protection against industrial hazards.* Whether it's oils, resins, solvents, heat or water—there's a Ply-Garb garment to fit the job and protect the wearer.

*Made for comfort,* Ply-Garb's new plastic weaves are soft, silken in texture and extremely light in weight. They can be tailored for complete freedom of action. Ply-Garb retains its flexible comfort and appearance through repeated washings.

*Ply-Garb outwears cotton and wool* 10 to 1. Ply-Garb must pass severe tear and strength tests—assures garment life many times beyond the normal wear of ordinary fabrics. This longer wear eliminates frequent and costly replacements.

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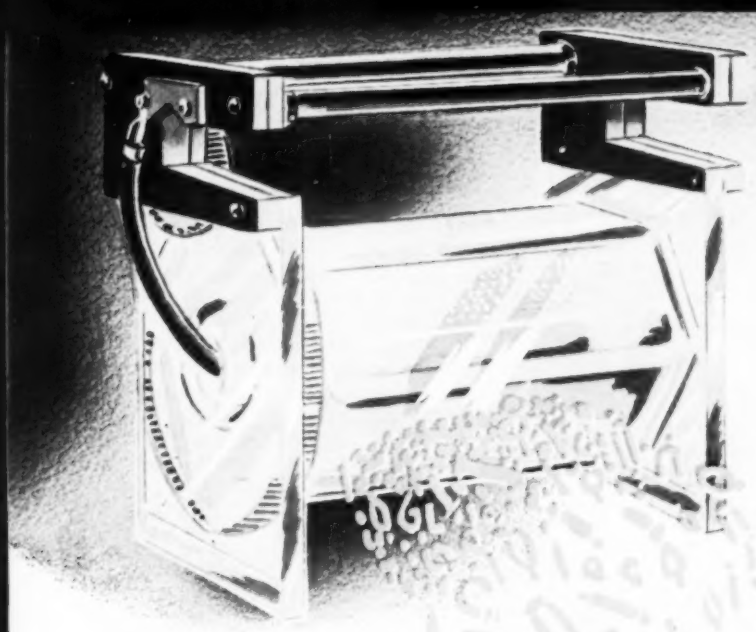

*Just note these claims for* Sel-Rex

# BRIGHT GOLD PROCESS

Patent Applied For

## *and compare them with conventional gold processes!*

**Brightness without burnishing, scratch brushing and/or buffing.**

**Greater "throwing power" to get into deep crevices and fine holes.**

**Consistent uniformity of deposit because of remarkable metal distribution.**

**Stable electrolyte — easily maintained.**

**Constant efficiency — at room temperature.**

**Superior corrosion and abrasion resistance.**

**We suggest you take advantage of our trial test offer and learn first hand the remarkable possibilities of this revolutionary new process.**

Sel-Rex

*Manufacturers of SEL-REX Silver Sol-U-Salt, Gold and Rhodium*

**SEL-REX PRECIOUS METALS, INC.**

DEPT. PL-7 229 MAIN STREET • BELLEVILLE 9, N. J.

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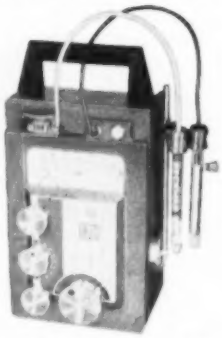
# BECKMANODIZING

**the new term in plating plants everywhere for accurate pH controlled ANODIZING!**

Solve your troublesome anodizing problems once and for all by using BECKMAN pH Control—a "must" in anodizing aluminum by the sulfuric acid or chromic acid methods where careful pH ranges have to be maintained. By far the fastest, simplest—and in the long run—cheapest way to measure pH accurately is with Beckman Glass Electrode pH Meters. Because Beckman pH Equipment does the job better for less—because Beckman has been responsible for nearly all major advances in this field—you owe it to yourself to investigate how BECKMAN can untangle your production snarls and cut costs.

**"Beckman pH Instrumentation is absolutely essential for close control in anodizing!", says Crown City Plating Company. For full details, see your Beckman Dealer, or write for Data File 62-72**

**GENERAL PURPOSE** — Beckman Model H-2 pH Meter. A line operated "workhorse" designed for plug-in convenience on 115 v AC circuits and 24-hour duty. Permits instant measurements without turning on and adjusting instrument.



**PORTABLE** — Beckman Model N pH Meter. This compact, easily carried traveling laboratory contains everything you need for making pH measurements around your plant. Low price, light weight, battery-operated. Accuracy within 0.03 pH.

**Beckman** *division*

BECKMAN INSTRUMENTS, INC.
FULLERTON 1, CALIFORNIA

# *Intersociety News*

### MEPA Annual Banquet

Over 420 members, suppliers and guests in attendance at the 36th annual celebration sponsored by the Masters' Electro-Plating Association, Inc., had a thoroughly enjoyable evening at the Starlight Roof of the Waldorf-Astoria, New York.

*J. Nelkin presenting "man-of-the-year" award to F. Kaiser, shown accompanied by Mrs. Kaiser (Plating Photo)*

Featured at the affair was the presentation of an award to Frank Kaiser of Long Island Mechanical Plating Co. as the area's "man-of-the-year" in plating.

### ASTM Awards of Merit

Eleven technical leaders in the field of engineering materials were honored during the ASTM 57th Annual Meeting in Chicago the week of June 14 when they received Awards of Merit. Those honored were: H. A. Anderson, Western Electric Co., Chicago, Ill.; B. A. Anderton, Barrett Div. of Allied Chemical & Dye Corp., Edgewater, N. J.; James Aston, A. M. Byers Co., Pittsburgh Pa.; R. F. Field, General Radio Co., Watertown, Mass.; O. M. Hayden, E. I. du Pont de Nemours & Co., Wilmington, Del.; E. F. Kelley, U. S. Department of Commerce, Washington, D. C.; G. M. Kline, National Bureau of Standards, Washington, D. C.; S. S. Kurtz, Jr., Sun Oil Co., Marcus Hook, Pa.; E. E. Thum, Editor, METAL PROGRESS, American Society for Metals, Cleveland, Ohio; Sam Tour, Sam Tour & Co., Inc., New York, N. Y.; and H. L. Whittemore, National Bureau of Standards, Washington, D. C.

**POSITION WANTED**

METALLURGICAL ENGINEER—30, 6 years experience including the technical aspects of heat treating and plating (zinc, cadmium, copper and bright nickel) of small parts. Other experience includes metallographic techniques, laboratory supervision and project investigation and developmental work. Desires responsible position in the production phase of physical or electro metallurgy.

*Reply to:*

P-754-C, PLATING
445 Broad St., Newark 2, N. J.

# LEA newsreel

JULY, 1954

## LEA COMPOUND

**Greaseless Composition for clean, effective and economical finishing on a wide variety of products.**

For Polishing, Buffing, Burring, Satin Finishing; can be used on metals, plastic and wood.

### CASE STUDY #1

***Material:*** Brass.
***Article:*** Escutcheon plates, and other builders' hardware.
***Method of Forming:*** Wrought.
***Final Finish:*** Imitation Butler silver.

***Lea Method:***

1. 120 grease set-up wheel.
2. Clean by acid dip.
3. Lea Compound Grade "N" on 10" diameter loose muslin buff 64/68 at 1800 r.p.m.
4. Nickel plate.
5. Lea Compound Grade "N" or "F" on 10" diameter loose muslin buff 64/68 at 1400 r.p.m.

***Remarks:*** The Lea Method gave a better imitation of silver and materially lowered costs by eliminating cut-down buffing operation formerly used after the polishing step, and all cleaning and drying after final satin finishing operation.

### CASE STUDY #2

***Material:*** Brass.
***Article:*** Escutcheon plates, door handles, etc. All types of builders' hardware.
***Method of Forming:*** Cast.
***Final Finish:*** Brushed brass.
***Lea Method:***

1. 120 set-up wheel.
2. Lea Compound Grade "N" on 10" loose buff at 1500 r.p.m.
3. Lacquering.

***Remarks:*** Lea Method eliminated the additional set-up wheel operation, cut-down buffing, cleaning and drying, and replaced the messy wet scratch brush step.

### CASE STUDY #3

***Material:*** Plastic (black Bakelite).
***Article:*** Knife handles.
***Method of Forming:*** Molding.
***Final Finish:*** High lustre.
***Lea Method:***

1. 180 dry belt sanding to remove heavy gates.
2. Lea Compound Grade "C" on a 10" diameter 1:1 packed muslin buff at 1750 r.p.m., for the removal of the parting line, and the marks at the end from the previous belt operation.
3. Cut-down buffing with Grade 306 Black Learok on a 12" diameter loose muslin buff at 1750 r.p.m.
4. Lustre buffing with Grade 304 Black Learok on a 12" diameter loose muslin buff at 1750 r.p.m.

***Remarks:*** Lea Compound on a packed buff is able to get in and out of finger grips on the handle and remove the parting line without any danger of burning. If a high lustre is not required, the smooth finish produced by Grade 306 Black Learok will be sufficient.

### CASE STUDY #4

***Material:*** Brass.
***Article:*** Pocketbook ornaments.
***Method of Forming:*** Stamped from sheet.
***Final Finish:*** Dull gold plate.
***Lea Method:***

1. Lea Compound Grade "S" on side of 6" medium hard felt wheel at 3600 r.p.m.
2. Lea Compound Grade "S" on 5" cloth buff at 1200 r.p.m.
3. Gold plate.
4. Lacquering.

***Remarks:*** The desired dull finish is produced by the Lea Method without any scratch brushing on the gold plate. The thickness of gold can therefore be decreased.

### CASE STUDY #5

***Material:*** Zinc.
***Article:*** Automobile hardware.
***Method of Forming:*** Die casting.
***Final Finish:*** Bright chromium.
***Lea Method:***

1. 150 set-up wheel on flash.
2. Lea Compound Grade "C" on 12" sewed buff at 2500 r.p.m.
3. Copper plate.
4. Cut and color buffing with Grade 155 Learok.
5. Bright nickel plate.
6. Chromium plate.

***Remarks:*** Flexible polishing with Lea Compound removes the irregularities in the surface left by the hard set-up wheel required to remove sharp, heavy flash. A smooth surface is produced on the zinc without lubrication, minimizing cleaning before plating.

### CASE STUDY #6

***Material:*** Zinc.
***Article:*** Interior trim for automobiles.
***Method of Forming:*** Die casting.
***Final Finish:*** Brush nickel plate.

***Lea Method:***

1. 120 set-up wheel.
2. Lea Compound Grade "C" on 12" pocketed type buff at 1800 r.p.m.
3. Nickel plate.
4. Lea Compound Grade "F" on the same type buff at 1200 to 1500 r.p.m.

***Remarks:*** Flexible polishing with Lea Compound is substituted for cut-down buffing plus wet scratch brushing. The final Lea Compound operation leaves the work ready for assembling without cleaning and drying.


LEA GRIPMASTER®
POLISHING WHEEL CEMENT
matching the high quality of other Lea Products, is now obtainable through
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**THE FOLLOWING EXCELLENT REBUILT AND GUARANTEED ELECTROPLATING MOTOR GENERATOR SETS AND RECTIFIERS, WITH FULL CONTROL EQUIPMENT:**

**PLATERS**

1—7500/3750 AMPERE, 9/18 VOLT, **HANSON-VAN WINKLE-MUNNING,** Synchronous.
1—5000/2500 AMPERE, 8/16 VOLT **ELECTRIC PRODUCTS,** 25° C., Synchronous. Exciter-in-head.
1—5000/2500 AMPERE, 9/18 VOLT, **COLUMBIA.**
1—5000/2500 AMPERE, 8/16 VOLT, **CHANDEYSSON,** 25° C., Exciter-in-head.
1—5000/2500 AMPERE, 6/12 VOLT, **CHANDEYSSON,** 25° C., Synchronous. Exciter-in-head.
1—4000/2000 AMPERE, 6/12 VOLT, **CHANDEYSSON,** 25° C., Exciter-in-head.
1—3000/1500 AMPERE, 6/12 VOLT, **ELECTRIC PRODUCTS,** Synchronous. Exciter-in-Head.
1—2500/1250 AMPERE, 9/18 VOLT, **ELECTRIC PRODUCTS,** Synchronous. Exciter-in-head.
1—2000/1000 AMPERE, 8/16 VOLT, **ELECTRIC PRODUCTS.**
1—1500/750 AMPERE, 6/12 VOLT, **HANSON-VAN WINKLE-MUNNING,** Synchronous, Exciter-in-head.
1—1500/750 AMPERE, 12/24 VOLT, **CHANDEYSSON,** Synchronous, Exciter-in-head.
1—1000/500 AMPERE, 6/12 VOLT, **ELECTRIC PRODUCTS.**

**ANODIZERS**

1—4000 AMPERE, 40 VOLT, **CHANDEYSSON,** Exciter-in-head.
1—1000 AMPERE, 30 VOLT, **IDEAL,** Exciter-in-head.
1—1000 AMPERE, 40 VOLT, **CHANDEYSSON,** 25° C.
1—750 AMPERE, 60 VOLT, **HANSON-VAN WINKLE-MUNNING,** Synchronous, Exciter-in-head.
1—500 AMPERE, 25 VOLT, **CHANDEYSSON,** Synchronous, Exciter-in-head.
1—400 AMPERE, 40 VOLT, **M. G. C.,** Exciter-in-head.

**RECTIFIERS**

BRAND NEW BASIC RECTIFIERS, 1500/750 amperes, 6/12 volts. Special Price: $750.00 each. Separate Voltage Controls available.
1—2000/1000 AMPERE, 6/12 VOLT, **G. E.,** COPPER OXIDE, with Manual Control.
1—2000/1000 AMPERES 6/12 volt G. E., brand new selenium stacks, with "On-load" Automatic Voltage Regulator.
1—**GREEN SELECTOPLATER,** 1800 AMPERE, 12 VOLT, 220/3/60.
2—**UDYLITE-MALLORY,** 1500/750 AMPERE, 6/12 VOLT, Control.

**SPECIAL**

1—**RANSOHOFF** SPIRAL HOT AIR DRYER.
1—**CROWN** 18 x 18 CENTRIFUGAL DRYER, Steam Heat.
3—No. 1 and No. 2 **HARTFORD** TRIPLE-ACTION BURNISHING BARRELS, Lined and Unlined, Belted.

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**95 WHEELER STREET**
***Kirkland 7-5460*** **CAMBRIDGE 38, MASS.**


# *Personals*

**Walter A. Mazan** has been added to the industrial department service staff of Wyandotte Chemicals Corp., Wyandotte, Mich. He will be connected with Wyandotte's Cleveland sales office and will headquarter in Toledo, Ohio.

Mazan

Mazan is a graduate of the University of Toledo, majored in chemistry, has done metallurgical work at Georgia Institute of Technology and has supervised a commercial metals laboratory. He is a member of the ASM, the American Foundrymen's Society and converses in 3 foreign languages.

**Clare R. Schuur,** co-owner of The Accurate Tumbling Co., Detroit, has organized the Universal Tumbling Supply Co., following the purchase of the 200-acre Sturgeon Bay Quarry of Sturgeon Bay, Wis.

Schuur

The quarry for the past 25 years has supplied the majority of American manufacturers with tumbling chips used in barrel finishing for burring, honing and polishing metal parts.

The new Universal Tumbling Supply Co., with headquarters at 14337 Mansfield Ave., Detroit, will sell direct to manufacturers at greatly reduced prices, according to Schuur.

"Our newly organized company is able to reduce the cost of industrial tumbling chips by nearly half because of our unlimited supply of raw materials and our ability to serve the manufacturer direct," Schuur said.

Schuur has been in the tumbling field for the past 15 years. Prior to establishing his parts processing plant, the Accurate Tumbling Co., he was for 5 years sales engineer for the Sturgis Products Co., which is now the Roto-Finish Co., of Kalamazoo, Mich. He is a member of the AES and other industrial and technical organizations.

**Dr. Vernon A. Lamb** of the National Bureau of Standards has received the Department of Commerce Silver Medal for Meritorious Service. The award was made "for outstanding contributions and distinguished leadership in development engineering in the field of electrodeposition."

Lamb

Dr. Lamb, who received his undergraduate and graduate degrees from the State University of Iowa, PhD, 1937, has been on the staff of NBS since May, 1941, becoming assistant chief of the electrodeposition section in January, 1952. He has conducted important investigations on electroforming, electropolishing, and iron plating. Of especial significance was his work on chromium plating for ordnance which led to the development of techniques for uniformly electropolishing and plating gun barrels. The process is the basis for the commercial production of gun barrels of greatly improved accuracy-life.

Dr. Lamb is a member of the ACS, the Electrochemical Society, and the AES.

**David M. Spillane** was appointed Chicago district manager by the Graver Water Conditioning Co., New York City. Spillane was New York sales engineer for the company prior to the new assignment. He had considerable sales and engineering experience before joining Graver, where he started in the sales estimating department. Spillane is a graduate of St. Peters College in Jersey City, N. J.

**Dr. Charles L. Faust,** chief of the division of electrochemical research at Battelle Institute, Columbus,Ohio, discussed current research in his field at the Fourth International Conference on Electrodeposition and Metal Finishing, in London, England.

In one paper, Dr. Faust discussed a study aimed at developing an electrochemical process for making porous electroplates from such metals as copper and nickel. Coauthor was **William Safranek,** also of the Battelle staff.

In another paper, Dr. Faust reported on recent American developments and the commercial status of electropolishing.

**William C. "Bill" Enright** was named sales manager by the Automotive Rubber Co., Inc., Detroit, Mich.

Enright

A native Detroiter, Enright is a graduate of the University of Detroit, with BME and LLB degrees. He is also a member of the Michigan State Bar Association.

Before joining ARco, "Bill" Enright spent 10 years as a metallurgical engineer with the Chrysler Corp. Following that, he was made district sales engineer for Western Felt Works, a post he held for 3 years.

Coming to ARco in 1939, Enright served as a sales engineer for the next 6 years.

In his new position, as the ARco Sales Manager, Enright's functions will consist of all phases of ARco rubber products manufacture, materials compounding, fabrication, and lining services, involving Automotive Rubber Company facilities in Detroit and Kalamazoo, Mich.

**Charles C. Coscia** has been appointed the Kanigen Division representative for the New York office of the General American Transportation Corporation. He formerly was in their Turbo-Mixer division, and for several years was a group leader in GATC's research and testing laboratory while the Kanigen process was being developed.

Coscia

Upon graduating from college, he was employed by the Pyridium Corp. as a research chemist, and worked on sulfa drug development.

Coscia holds a B.S. degree from New York University. He is a member of the AES and ACS.

# Our platers would not use anything but WYANDOTTE "F. S." and "B. N."

**—Bud Ebner, Superintendent, Superior Plating, Inc., Minneapolis, Minn.**

Wyandotte electrocleaners **F.S.** and **B.N.** are doing a whale of a job for Superior Plating, Inc., important plating job shop, Minneapolis, Minn.

Bud Ebner, Superior's superintendent, reports: "We have a variety of cycles set up to handle many different jobs in our shop. In all of these cycles, ***Wyandotte*** **F.S.** and **B.N.** play an important part. **Our platers report definitely better results with these electrocleaners and would not use anything else! We're thoroughly sold on Wyandotte products and service!"**

Try these Wyandotte electrocleaners yourself: **B.N.** is an excellent electrocleaner for ferrous and nonferrous metals. Highly versatile, it is particularly recommended for the job shop. Many shops also use ***Wyandotte*** **B.N.** for stripping chromium. **F.S.** is used for heavy-duty anodic electrocleaning of ferrous metals before electroplating. ***Wyandotte*** **F.S.** combines exceptional detergency for removal of fabricating oils and compounds with controlled foaming, free rinsing and high soil suspension ability. **F.S.** has outstanding solution life.

Use *quality* products for *best* electrocleaning results . . . and still do the job *at lowest use-cost!* Use *only* Wyandotte electrocleaning products, constantly being tested, developed and improved in Wyandotte's new metal-cleaning and electroplating laboratory. Call your helpful Wyandotte technical representative or mail coupon today for details, without obligation. *Wyandotte Chemicals Corporation, Wyandotte, Michigan. Also Los Angeles 12, California.*

Wyandotte CHEMICALS

*Helpful service representatives in 138 cities in the United States and Canada*

**Largest manufacturers of specialized cleaning products for business and industry**

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Department 2212
Wyandotte, Michigan

Please send me free technical information on:

☐ B.N. ☐ F.S.

Name_____

Firm_____

Address_____

City_____ State_____

**Edward L. Kost** has been appointed general manager of the Industrial Lining Division by the Chase Chemical Corp., Pittsburgh, Pa. Kost has been superintendent of the lining plant at Edgeworth, Sewickley, Pa., and will be located now at the company's office, 3527 Smallman St., Pittsburgh.

**Sidney Andrews** has been named vice-president in charge of research and development for the Metal Removal Co. of Chicago. Andrews will be working on the firm's abrasive grinding wheels, discs, and mounted points.

**Donald H. Schultz** has been appointed sales representative in the Wisconsin area for Circo vapor degreasers and other Circo metal cleaning products.

Schultz has been active for the past 8 years in the distribution of metal finishing equipment and supplies in the Wisconsin area. He is a member of the AES.

Schultz has been placed in charge of Circo's Milwaukee office.

**John D. Vickrey** has joined the engineering department of International Rectifier Corp., El Segundo, Calif., as sales and application engineer for selenium rectifiers.

Vickrey was formerly assistant manager for Lee Electric Mfg. Co. and prior to that was sales and application engineer with Vickers Electric Division, Vickers, Inc.

Also announced was the appointment of **Frank J. Perna,** as their representative to parts jobbers, covering the area of eastern Pennsylvania, northern New Jersey, District of Columbia and Maryland.

Named International Rectifier Corp. representatives in northern Illinois and eastern Wisconsin were Langhaus-Levy Associates, 315 W. Walton St., Chicago. Both **Marv Langhaus** and **Ken Levy** are well known to all of the jobbers in the territory.

**Robert M. Norton** has been named to the post of vice-president and **Myron B. Diggin** to that of assistant vice-president by Hanson-Van Winkle Munning Co.,

**Norton** **Diggin**

Matawan, N. J. Both will continue their responsibilities as sales manager and technical director, respectively.

Sales manager for the last 4 years, Norton has been with H-VW-M for 14 years. He joined the company as a salesman, became sales representative in New York State in 1941 and 4 years later was appointed district manager of the state.

A year after that, his managerial responsibilities were expanded to include upper New England. In 1948, he moved into the home office as assistant sales manager.

Norton was graduated from Dartmouth College with an AB degree in 1933, and took postgraduate courses in chemistry at Rutgers University.

Diggin has been with H-VW-M for the past 24 years, and was appointed technical director 8 years ago. He joined H-VW-M as a chemist, and was appointed chief chemist in 1933.

He was graduated from Wesleyan University with a BS in chemistry in 1926, and was awarded an AM degree from the same university 2 years later. He taught chemistry at Wesleyan, established a consulting chemical laboratory, and later joined the technical staff of a chemical manufacturer.

Diggin is a member of the Electrochemical Society, ACS, American Ordnance Association, AES, ASTM, Institute of Metal Finishing, American Institute of Chemists, and the AES Research Committee. In 1946, he was awarded the AES gold medal.

**A. A. Benderly** recently was appointed Chief of the Materials Section of the Diamond Ordnance Fuze Laboratories, Washington, D. C. Earlier in his career, he served as an AES research associate at the National Bureau of Standards.

Benderly was elected president of the Baltimore-Washington Branch of the AES at its April meeting.


Nice Product, Nice Package

Folks often wonder why we spend an extra ¼¢ a pound out of our own pockets for a lithographed drum. Fact is we're proud of the quality of BFC Chromic Acid and figure it deserves a bright, colorful container.

Every batch gets checked against a tough quality spec. Off-grade acid goes on the dump. Only top-quality material goes into those shiny BFC drums. Send us a modest order and see for yourself.

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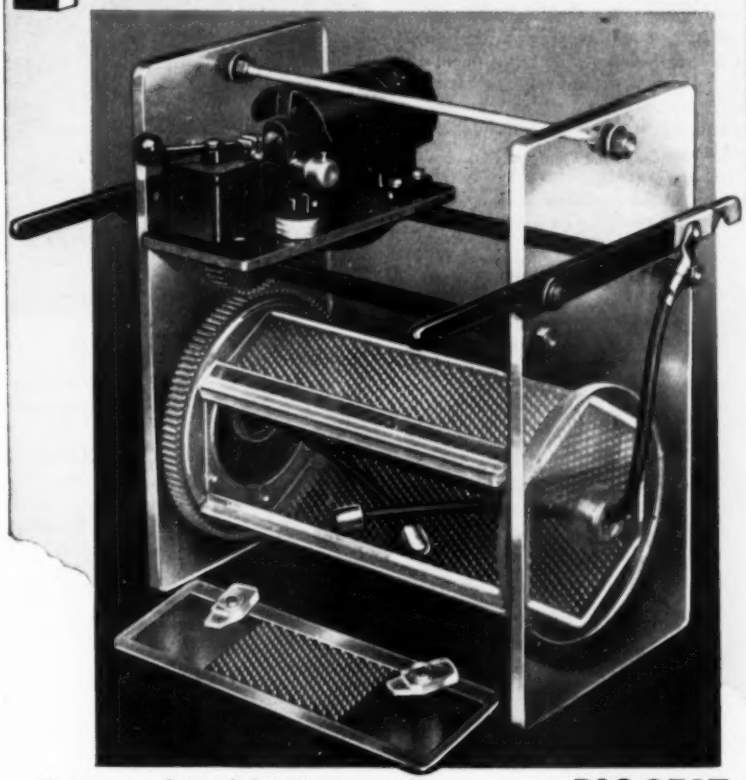
122 East 7th St., Los Angeles 14, Calif.

BFC Plating Chemicals

# Belke New LUCITE PORTO-PLATER



only $167.50

*with 9x15" O.D. Cylinder*
*115 V, 60 C, 1 Ph. Motor*

**also**
***14x30 and 14x36 Plating Barrels and full Barrel Cycle Lines at very reasonable prices!***

*Ask your BELKE Service Engineer or write.*

**Features of Model SPX Porto-Plater**

Notched "V" Cathode Contact fits Cathode Rod at any point on the rod.

Complete Lucite End Plates — Support plater — protect cylinder and mechanism in handling.

Reversing Switch with self-contained motor drive —Motor turns cylinder in either direction and holds positively for loading and unloading.

Obstruction-free Cylinder—One-piece molded High Temperature Lucite shell welded to cylinder ends. No ribs, no tie rods, no crevices.

Attached Lucite Cover Locks — Always on the cover. Never misplaced or dropped in tank.

Ball Contact with one-piece dangler cable.

High Temperature Lucite—Cylinder, cover, cover locks, hangers, gears and bushings.

Cylinder perforations 3/32" unless specified.

Cylinder, O.D. 9x15"; I.D. 6x12".

Weight Empty, 28 lbs. Plating Capacity, ¼ peck.

Geared head motor, 1/50 HP, 115 V, 60 C, 1 Ph.

## BIGGEST VALUE ever produced in a LUCITE PORTO-PLATER

New features and low price, made possible by BELKE BIG VOLUME PRODUCTION, add up to TREMENDOUS VALUE far greater than ever before obtainable.

A flood of orders in excess of production has created a big backlog with extended delivery dates.

To avoid disappointment, please order well in advance of your needs. Deliveries must be scheduled on the basis of first come first served.

Belke Manufacturing Company
947 N. Cicero Ave., Chicago 51

EVERYTHING FOR PLATING PLANTS

# Trade Literature

**L—700. Magnetic Amplifier Bulletin**—Advance information on a magnetic amplifier incorporating a new design principle for voltage regulation is now available in a new bulletin from the Rapid Electric Co., 2881 Middletown Road, Bronx 61, N. Y.

The new design incorporates circuitry and construction features that provide magnetic amplifier regulation at the lowest possible cost without sacrificing wide voltage control range and stability.

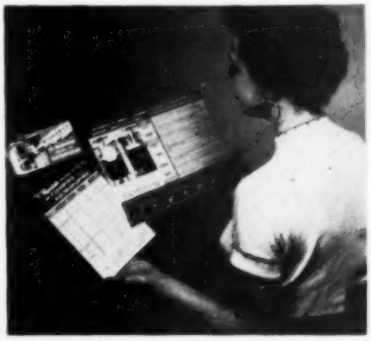
The rectifying elements in the unit are of the dry plate selenium type. A small potentiometer permits voltage adjustments to meet the desired range. The units have complete overload safety features and are fan cooled when required.

The units have been designed to give the highest possible results while maintaining low initial cost. For your copy of the bulletin, use Reader Service Card.

**L—701. Handy Pocket Card Shows Flame Spectra For Typical Inorganic Elements**—A new, pocket-size card which carries emission spectra for 36 of the most typical elements determinable by modern flame spectrophotometry has been made available by Beckman Instruments, Inc., South Pasadena, Calif.

The card is designed as a handy reference for the flame analyst and for chemists interested in this new analytical technique. Emission lines are superimposed on a full-color spectrum from 300 to 900 millimicrons. Copies can be obtained by using Reader Service Card.

**L—702. Wyandotte Issues Guide For Cleaning Prior to Electroplating**—A circular "Wyandotte Products for Cleaning Prior to Electroplating," details the features of the 11 products described in



the folder, including the dust-free and foam-cutting abilities of the 3 electrocleaners. Two valuable charts also are included in this circular.

One of the charts details a typical cycle for preparing metal for plating. The second chart is a products guide for cleaning before electroplating. Information is contained in the charts and in the folder regarding acid treatment, electrocleaners and soak cleaners.

Copies of this Wyandotte circular may be secured from any of Wyandotte Chemicals' 17 district sales offices, or from local Wyandotte sales and service supervisors who headquarter in 138 North American cities or through use of Reader Service Card.

**L—703. Purification of Chromic Acid Copper Stripping Solution**—The Industrial Filter & Pump Mfg. Co., 5900 Ogden Ave., Chicago 50, Ill., has issued a new bulletin on the ion-exchange system for purification of chromic acid copper stripping solutions. The operation of the system is described in detail. Included is a tabulation of costs and savings. For your copy, use Reader Service Card.

**L—704. Process Timer Bulletin**—An 8-page bulletin on a new process timer has been announced by the General Electric Co., Schenectady 5, N. Y.

Designated GEC-1223, the 2-color publication describes in detail the operation, advantages, and applications of the company's new type TSA-18 process timer. Also included are connection diagrams for typical applications, as well as installation and "cut-away" illustrations, prices, specifications, and dimensions. For your copy of this literature, use Reader Service Card.


BRASS PLATING WITH TRUE BRITE

❶ improve color

❷ save labor

❸ eliminate supervision

❶ *color stays constant . . . no rejects*

❷ *eliminates frequent analyses . . .*

❸ *trouble free . . . only one addition instead of three*

Write for FREE bulletin! Your key to better Brass Plating

Available in regular 3 to 1 ratio for yellow Brass Plating.

Special ratio materials for plating richlow brass or any other desired alloy of copper and zinc.

Suitable for both still tanks and barrels.

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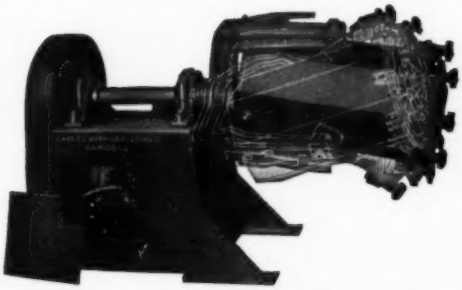
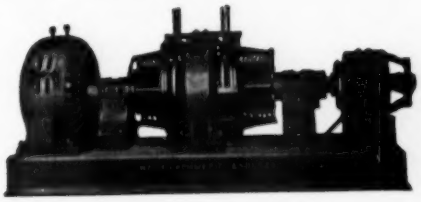


TYPE "L" SIZE 2 BURNISHING BARREL



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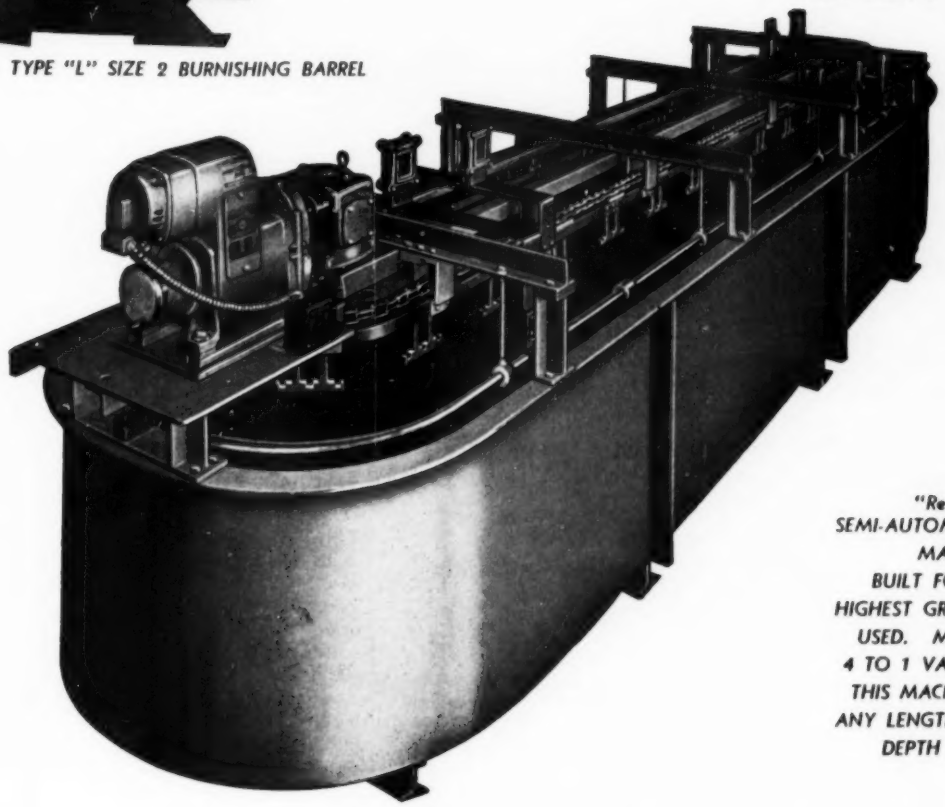

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## *Trade Literature*

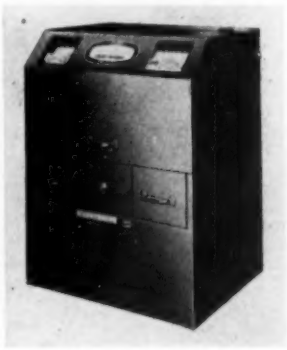
**L—705. Precious Metal Pressure Control Discs**—A new brochure on the uses and applications of precious metal rupture discs has been issued by Baker & Co., Inc., Newark, N. J.

The booklet is designed to give chemical engineers a concise, yet definite reference work containing all important information and data they need to select the most effective type of rupture disc for a specific product or process.

Characteristics of the various precious metals are discussed, with particular reference to their behavior in the presence of corrosion and pressure. The booklet contains several tables of data which present comprehensive information concerning the reaction of platinum, silver and gold to the principal corrosion agents, and the bursting pressure (PSI) of rupture discs made from these metals in various working diameters. For your copy, use Reader Service Card.

**L—706. Platecoil Brochure**—A 12-company report on the use of Platecoils in a variety of process heating and cooling applications has been published in a 20-page brochure by Tranter Manufacturing, Inc., 736 E. Hazel St., Lansing, Mich. This bulletin shows how savings can be made in 12 different processing operations through factual reports on the experiences of companies who are making these savings. Reports run the gamut of heat transfer applications from alkaline stripping and flexseal coating to tar transfer and quench oil cooling. For your copy of the brochure, use Reader Service Card.

**L—707. Barrel Finishing Machine**—Almco Supersheen's new model DBO-1A barrel finishing machine is described fully in a new bulletin. The unit is a new, compact model that features less floor



space, simplified operation, finger-tip control. Variable speeds are from 8 to 45 rpm and the all-in-one control and drive unit is built-in panel mounted. Twin barrels are 8 inches wide by 16 inches across the flats. Self-contained screening drawer for loading, unloading, separating parts from media are provided. For your copy of the literature, use Reader Service Card.

**L—708. Bulletin Describes Wagner Brothers' Rectifiers**—A new illustrated 8-page bulletin describes different types of Wagner Brothers' electroplating rectifiers, with capacities from 5 to 50,000 amperes, standard and special designs. It also covers regulators and controls for use in the plating industry. For your copy of the bulletin, write to Wagner Brothers, Inc., 400 Midland Ave., Detroit 3, Mich., or use Reader Service Card.

**L—709. Bulletin on Cut-Off Wheels**—A bulletin on Manhattan cut-off wheels issued by the Manhattan Rubber Division, Raybestos-Manhattan, Inc., Passaic, N. J., includes recommendations with wheel grade numbers for a wide variety of materials. Valuable operating suggestions for improved and faster metal cutting and photos showing the wheels installed on various types of machines also are included. Copies may be had by using Reader Service Card.

**L—710. Permanite Diaphragm Valves**—Maurice A. Knight, Kelly Ave., Akron 6, Ohio, has released a bulletin covering a new and unique type of valve. This valve has many outstanding features never before found in any single design. It is made of Permanite a thermosetting furfuryl alcohol resin, and will handle most acids including HF, HCl, as well as oils, alkalies and organic solvents at sustained temperatures in excess of 240° F. It is lightweight but very dense, strong, and shock resistant. For your copy, use Reader Service Card.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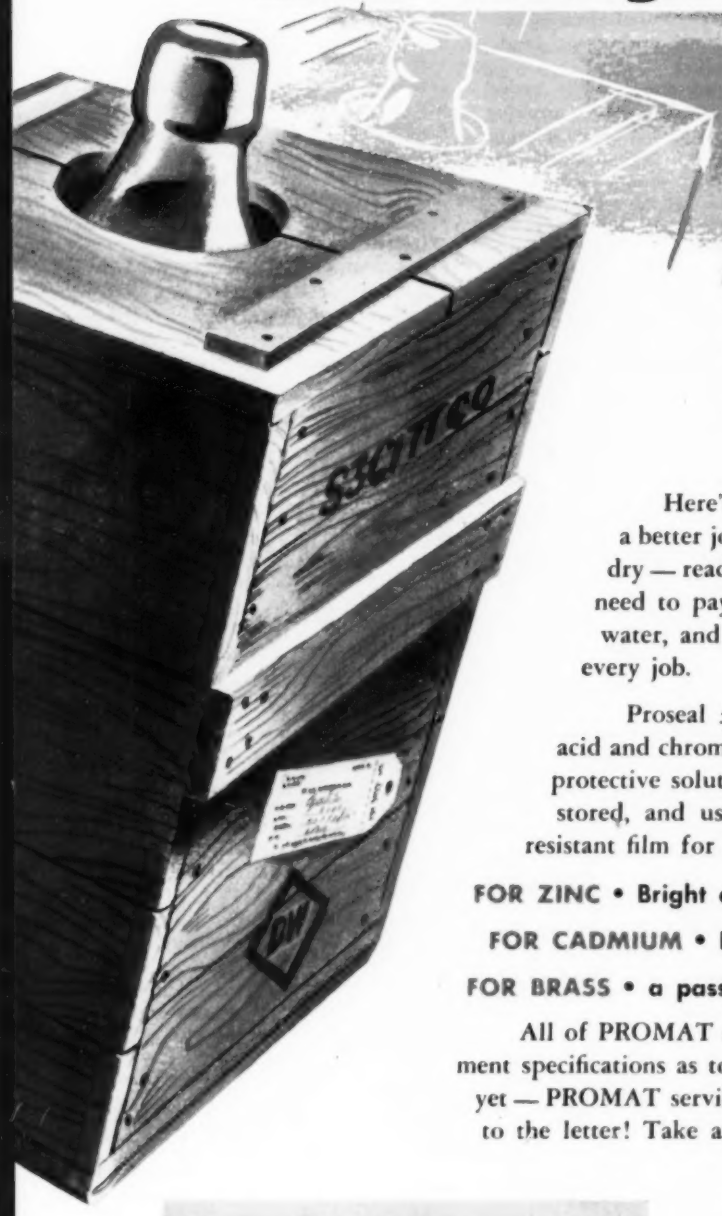

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**FOR BRASS • a passivating treatment**

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# Equipment and Supplies

**E—711. Versatile Polishing Head**—The Murray-Way Corp., P. O. Box 180, Birmingham, Mich., announces a new, heavy-duty, multipositioning buffing head with many unusual features.

The new head, known as the No. 55, can be positioned for any job by means of simple, conveniently located adjustment controls on the front of the head. It can be rotated in a full 360 degree swing on both axes, simultaneously; and automatic positioning provides constant, full contact on even the most irregular shaped piece. An adjustable float restrictor controls the degree of rise and drop of the wheel. For more information on this equipment, use Reader Service Card.

**E—712. Detrex Product for Spray Washers**—Development of a new alkaline cleaner for use in mechanical spray washers prior to phosphate coating, and which is entirely free of caustic soda, has been announced by the Detrex Corp., Detroit, Mich.

L. C. Camel, sales manager of the Detrex Chemical Processing Division, said the new product has a broad application in the metal-fabricating industry in that it embodies "all of the qualities that are required for the cleaning of steel in mechanical washing equipment."

By eliminating caustic soda, the crystalline structure of the phosphate coating is made much finer and more effective. The product may be used at various concentrations and temperatures for the removal of oils and greases from fabricated parts prior to subsequent operations. Concentration of this cleaning compound is entirely dependent upon the type and degree of soil involved.

The new cleaning compound has a balanced formulation which permits saponification as well as emulsification of soils when in solution.

Despite its broad application, this new compound is not a product which increases the cleaning cost for the consumer. Camel said, "It is so well-balanced that it is expected to reduce cost as well as give the consumer a better cleaned surface that will result in a better end-product." For more information on this new product, use Reader Service Card.

**E—713. Hand Tachometer**—A new portable, hand tachometer, featuring a scale-changing device which reduces misreading of its various ranges, has been announced by the General Electric Company's Meter and Instrument Dept., Schenectady 5, N. Y.

Three different models, each having three ranges, are capable of measuring rotational speeds from 2 to 100,000 rpm and linear speeds from 2 to 10,000 fpm with accessories. Accuracy is plus or minus 1 per cent of full scale under all conditions, according to G-E engineers.

Applications of the tachometer include speed measurement of motors, generators, turbines, lathes, milling machines, planer beds, shapers, band saws, conveyor belts, and all continuous webs. For more information on this instrument, use Reader Service Card.

**E—714. Zinc Phosphate Coating Material for Iron and Steel**—Oakite Products, Inc., 140 Rector St., New York, N. Y., have announced the addition to the company's group of prepaint conditioning materials of Oakite CrysCoat SW, a new zinc phosphate coating material for iron and steel, designed for use in pressure-spray washing machines.

CrysCoat SW, the manufacturers state, provides a fine-grained, dense and uniform zinc phosphate coating on iron and steel that meets U. S. Government specification Jan-C-490, Grade I, and similar specifications. The coating weight ranges from 180 to 220 mgs per square foot. One-minute application in the phosphating stage of a 5-stage pressure-spray washing machine is usually sufficient to obtain the coating weight desired, it is reported. For more information on this product, use Reader Service Card.

**E—715. New Process Electroplates Nickel Directly on Aluminum**—Development of a process for applying nickel directly to either raw or anodized aluminum, to afford an erosion-resistant surface and to strengthen the aluminum materially, has been announced by the Bart Laboratories Co., of Belleville, N. J.

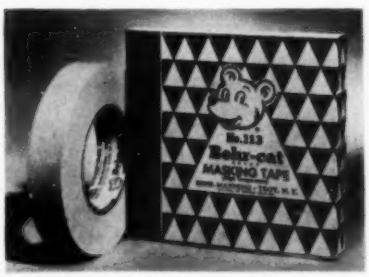
The new electroplating process solves a major problem in coating aluminum with nickel by eliminating the need for an intermediate bonding material, such as copper or adhesive cements, and establishes a bond previously considered impossible.

When deposited to both surfaces of aluminum sheets, the nickel deposit greatly strengthens the aluminum without materially increasing the weight. Intricate designs and shapes, such as castings, can be given uniform and accurate protection of both interior and exterior surfaces.

With the new "Alni-Clad" process, a stress-free, ductile and pore-free surface can be applied in any required thickness. The material produced can be sheared, bent or fabricated, and because of the tenacious bond, it is not subject to separation even at high temperatures.

Wide variation in the characteristics of the nickel deposited also can be secured. The hardness of the deposit can be varied over a wide range, from 150 to 550 Vickers. Nickel can be deposited in layers with a "soft" layer against the aluminum for resiliency and an extremely hard outer coating. In addition, the nickel can be deposited with either compressive or tensile stress. For more data on this new process, use Reader Service Card.

**E—716. High Temperature Masking Tape for Anodized Surfaces**—Behr-Manning Corp., Troy, N. Y., announces the addition of a new special high-temperature masking tape No. 113 to its existing line of pressure sensitive tapes. The




new tape was designed specifically for masking pretreated surfaces, such as anodized aluminum and magnesium. It will adhere at baking temperatures up to 350° F and is available to industrial consumers through Behr-Manning field engineers and industrial distributors. For more information, write Behr-Manning Corp., Division of Norton Co., Troy, N. Y., or use Reader Service Card.

**E—717. Nickel Plating Process More Versatile, 75 Per Cent Faster**—An improved nickel sulfamate plating process, developed by Hanson-Van Winkle-Munning Co., plates 75 per cent faster, is more versatile, easier to control and produces harder deposits with less brittleness than other sulfamate processes.

The new H-VW-M bath plates up to 0.007 inch of nickel per hour compared to a high of 0.004 inch per hour possible with other baths.

With this versatile process, deposits of low internal stress are obtained easily and a wide range of specific compressive and tensile stresses also are possible. Compressive stresses from zero to −9 x

$10^2$ psi and tensile stresses from zero to 18 x $10^2$ psi may be had by varying current density, temperature and concentration of the bath's addition agent. For detailed information on the process, use Reader Service Card.

**E—718. Plastic Work Gloves**—A brand-new line of industrial plastic work gloves has just been announced by Ed-

mont Mfg. Co., 1250 Walnut St., Coshocton, Ohio. The new line is called "Green Turtle," has long life and is competitively priced. Three styles are available—a palm-coated knitwrist, a fully-coated knitwrist and a fully-coated 12 inch gauntlet. All are made of full-cut, strong fabric liners—coated with a specially compounded, dark-green plastic. They are very flexible, have an excellent grip and the fully coated styles are guaranteed liquid proof. The modern coating has outstanding resistance to abrasion and will not chip, crack or peel. For more information on this product, use Reader Service Card.

**E—719. Diamond-Studded Nylon Belts**—Commercial diamonds, embedded in a belt of extruded DuPont nylon plastic, are solving die polishing problems posed by the replacement of conventional steels by ultrahard carbide in tube and rod drawing dies.

While carbide dies have upped production rates, their hardness has made polishing a major problem. Diamonds, the only polishing agent with sufficient hardness to cope with carbide dies, cannot be adhered satisfactorily to conventional fabric polishing belts. Where diamonds are used with the extruded nylon, however, the nylon provides a cushioning effect to keep the diamond grits from tearing out of their sockets. Further, the tough nylon resists wear so well that in tests as many as 460 dies have been polished with one belt. Finishes as fine as one-half microinch rms are being obtained, according to the manufacturer, Hartford Special Machinery Co., Hartford 12, Conn.

With the new belt, 20 minutes now are required for belt polishing, as opposed to four hours for the hand-lapping method it has replaced. For more information, use Reader Service Card.

**E—720. Magnetic Pump**—A new type of magnetic pump for industry has been announced by The Fostoria Pressed Steel Corporation, Fostoria, Ohio.

Known as the Dynapump, this novel centrifugal pump is driven by a rotating magnetic field instead of the usual drive shaft. This feature makes possible a low cost, leakproof, motor and pump unit that eliminates the need for a shaft seal, the major cause of conventional pump troubles. Standard units are made in fractional horsepower sizes of stainless steel for pumping most fluids. Special purpose usage models also are made. For more information, use Reader Service Card.

**E—721. Solvent-Handling Hose**—A new solvent-handling hose with high resistance to methyl ethyl ketone, acetone, methyl acetate and other alcohols and esters of petroleum was announced recently by Hewitt-Robins Inc., Stamford, Conn. The new hose utilizes a Thiokol tube and a heavy-duty tank-car type construction, making it serviceable for suction applications as well as simple discharge.

The hose will have particular use in the metal-working and paint and varnish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fields to transfer coolant oils, metal cleaning fluids and paint solvents from tank cars to factory storage.

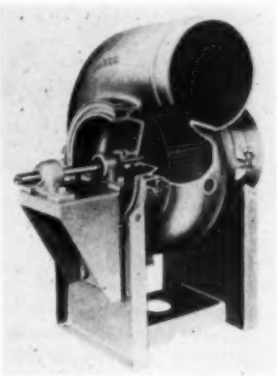
The hose is made in single 50 foot lengths in three diameters—2, 2½, and 3 inches. For more data on this product, use Reader Service Card.

**E—722. Wide Swing Polishing and Buffing Lathe**—A special model RPO wide swing polishing and buffing lathe is announced by Hammond Machinery Builders, 1613 Douglas Ave., Kalamazoo, Mich.

This is a two-spindle lathe, each spindle having its own motor, motor control and V-belt drive—allowing each operator to change wheels without interfering with or causing down time for the other. Each spindle runs in three ball bearings, one in the end of the spindle which is a part of the special outboard bearing assembly. The heavy-duty construction and rigidity of the outboard bearing permits the use of wheels up to 16 inch face on each spindle. This lathe is especially suited for polishing and buffing of large and irregular shaped parts either by hand polishing ing or in conjunction with semiautomatics. For further information, use Reader Service Card.

**E—723. Rigid PVC Large Diameter Tubing and Ducting**—Kaykor Industries, Inc., Yardville, N. J., announces the availability of Vyflex rigid polyvinyl chloride tubing and ducting in 6-, 8-, 10- and 14-inch inside diameters. Furnished in 4-foot straight lengths, Vyflex rigid polyvinyl chloride pipe and tubing are produced of completely unplasticized and unmodified PVC by a special process which has been perfected by the manufacturer. Several efficient joining methods may be employed to produce multiple pipe-length installations. For further information on properties, assembly methods and corrosion resistance, use Reader Service Card.

**E—724. Duriron Exhaust Fans**—The Duriron Co., Inc., Dayton 1, Ohio, introduces a complete new line of corrosion resisting exhaust fans. These fans feature



all-metal resistance to corrosive fumes and gases. The casing is of Duriron, one of the most universally corrosion resistant materials ever developed. The rotor is a multiblade, forward curved design of Durimet 20, a high nickel stainless steel.

These Durco B Series fans have capacities to 8,000 cfm. The new design and new construction make them approximately 40 per cent lighter in weight than the former Duriron fans. They are also more efficient and less expensive than previous fans. For more information on these fans, use Reader Service Card.

**E—725. Plastic Balls Reduce Chromium Spray Losses**—Cosom Industries, Inc., 6012 Wayzata Blvd., Minneapolis 16, Minn., have developed a solid ball manufactured from polyethylene which has been tested and used successfully in chromium plating tanks. The balls prevent excessive spray losses, cut down surface heat losses, reduce objectional fuming and reduce atmospheric chemical attack on adjacent equipment. For more information on this product, use Reader Service Card.

**E—726. Ultrasonic Energy Speeds Metal Cleaning**—The new "Sonogen" Model 500 Ultrasonic-Power Generator, manufactured by Branson Instruments, Inc., 430 Fairfield Ave., Stamford, Conn., is designed primarily for accelerating the cleaning and degreasing of small parts and metal objects such as strip, wire and tubing, as well as complex components. It functions by activation of the cleaning solvent in which is immersed the low-voltage focused ceramic transducer. Installation in conventional vapor degreasing systems is facilitated by long ca-

THAT'S RIGHT – Unichrome Coating 218X is so inert, it's approved by leading bright nickel producers. It won't contaminate or be attacked by other plating baths either. In fact, this tough, resilient green plastisol coating goes one step further. Since it doesn't form pockets, blister, chip or crack, it keeps rinsing freely – minimizing dragout and drag-in problems, too.

Over 5 years of service experience show Coating 218X quality cuts rack coating cost to the bone. It assures top resistance to all plating, cleaning, anodizing and even vapor degreasing cycles.

Remember, Coating 218X is produced by United Chromium . . . the company that has: (1) Developed plating processes; (2) Given service on plating problems; (3) Pioneered highly corrosion-resistant plastisol coatings . . . and therefore knows what a rack coating needs for maximum plating service.

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Once you have set the voltage or current on an automatically regulated General Electric Plating Power Supply, no further adjustments are needed. Automatic regulation maintains your setting within ±2 per cent, regardless of variations in line voltage or tank load. Equipment is available to automatically regulate voltage or current, or both.

**SAVINGS**—Automatic regulation saves you money several ways. There is no need to check and adjust current or voltage. By eliminating human error, it assures work of more uniform quality. It facilitates continuous production without expensive shutdowns for maintenance or adjustments. Finally, it greatly reduces your rejects caused by current or voltage variations.

**FLEXIBLE**—Automatic regulation will maintain any setting between 16 and 100 per cent of rated voltage, or 10 and 100 per cent of rated current. It is available as an integral part of G-E plating power supplies, or can be added later to manually controlled units.

**MORE INFORMATION** is available from any authorized G-E agent listed, or by writing Section 464-15, General Electric Co., Schenectady 5, N. Y.

**BARREL PLATERS**

Economical, 12-volt barrel platers are available in ratings from 500 to 2000 amperes. Your nearest agent has full information.

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## *Equipment and Supplies*

bles between the power unit and the transducer.

In addition to cleaning, the Sonogen is an economical source of ultrasonic power for many other laboratory and production uses involving liquids—such as emulsification, dispersion, and the acceleration of chemical reactions. For further details on the unit, use Reader Service Card.

**E—727. Five New Iridite Finishes**—Allied Research Products, Inc., 4004 E. Monument St., Baltimore 5, Md., manufacturer of the Iridite line of corrosion resistant finishes, has announced the development of 5 new protective coatings for zinc, silver, copper and aluminum.

New Iridites 4-73 and 4-75 (Cast-Zinc-Brite) provide a new method of obtaining a bright-type decorative and protective finish directly on zinc die castings. Iridite 4-73 is designed for Zamak No. 3 and similar alloy zinc die castings; Iridite 4-75 is designed for Zamak No. 5 and similar alloy zinc die castings.

Another new Iridite finish is designated as 18-P (Silver-Kote) and provides good tarnish resistance for industrial silver plate. This process provides a protective coating both in service and storage with minimum effect on electrical characteristics and solderability.

A third new process is Iridite 17-P (Cuprous-Kote) which provides greater corrosion resistance and paint adherence for copper and copper alloy surfaces.

A new process for aluminum is Iridite 14-2 (Al-Coat). Its operating conditions can be controlled to produce a finish ranging in appearance from yellow-iridescent to a uniform deep brown. An outstanding feature of Iridite 14-2 is that the coating can be bleached easily to produce a highly protective film with a clear-type appearance.

The 5 new products are applied by a simple chemical dip, without electrolysis and without the need for special equipment or specially trained personnel.

For full information on the new processes, use Reader Service Card.

**E—728. Vitrified Grinding Wheel**—Norton Co., Worcester 6, Mass., announces a new vitrified grinding wheel for foundry use at speeds up to 6500 surface feet per minute.

Known as the "K" Bond snagging wheel, this wheel gives up to 30 per cent longer life with faster, freer cut. "K" Bond was designed for Crystolon silicon carbide wheels in rough grinding cast iron. Other important advantages of the new grinding wheel are that less dressing is required to keep it sharp, the corners hold up longer without rounding, and the wheels can be duplicated consistently from wheel to wheel and lot to lot. Operator fatigue is lessened. For more information on this product, use Reader Service Card.

**E—729. Saf-I-Spectacle**—A unique, dual-purpose frame is one of the features of the new lightweight, all plastic Saf-I-Spectacle, manufactured by the United States Safety Service Co., 1215 McGee St., Kansas City 6, Mo.

The exclusive 2-for-1 design of the newly styled acetate frame permits instant change from regular to side shield model. Perforated acetate side shields that are nonflammable and nonsparking simply screw into place for jobs requiring side protection. This unique feature permits stocking of only one type spectacle to provide two types of eye protective equipment. For more information, use Reader Service Card.

**E—730. Electronic Temperature Controller**—Higher sensitivity, long term stability, reliability and low cost are featured in a new two-zone electronic temperature controller announced by the Fielden Instrument Division, Robertshaw-Fulton Controls Co., 2920 N. 4th St., Philadelphia, Pa.

The new unit is designed for a wide range of industrial applications in all industry where accurate temperature control is required. Because of its high sensitivity, the company said the new controller also is suitable for use in laboratory work.

Standard ranges are zero to 100, 300 or 500 degrees Fahrenheit and Centigrade but any range between the limits of minus 200 to plus 500° Centigrade can be supplied. For more information, use Reader Service Card.


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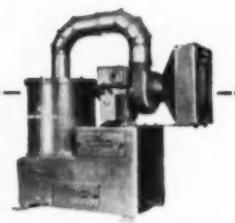

1. **Standard Model.** Takes nearly every type of part. Built for long, trouble-free service.

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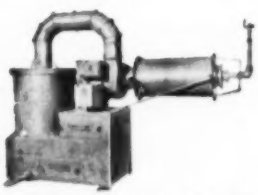

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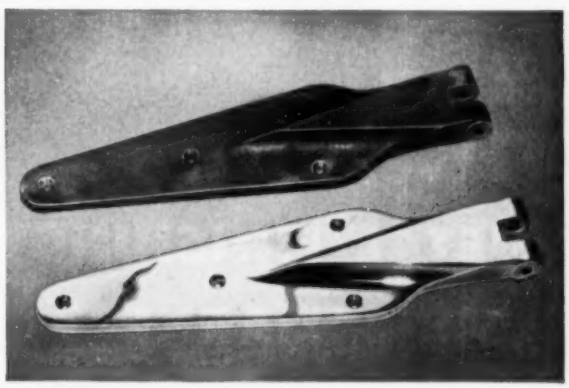

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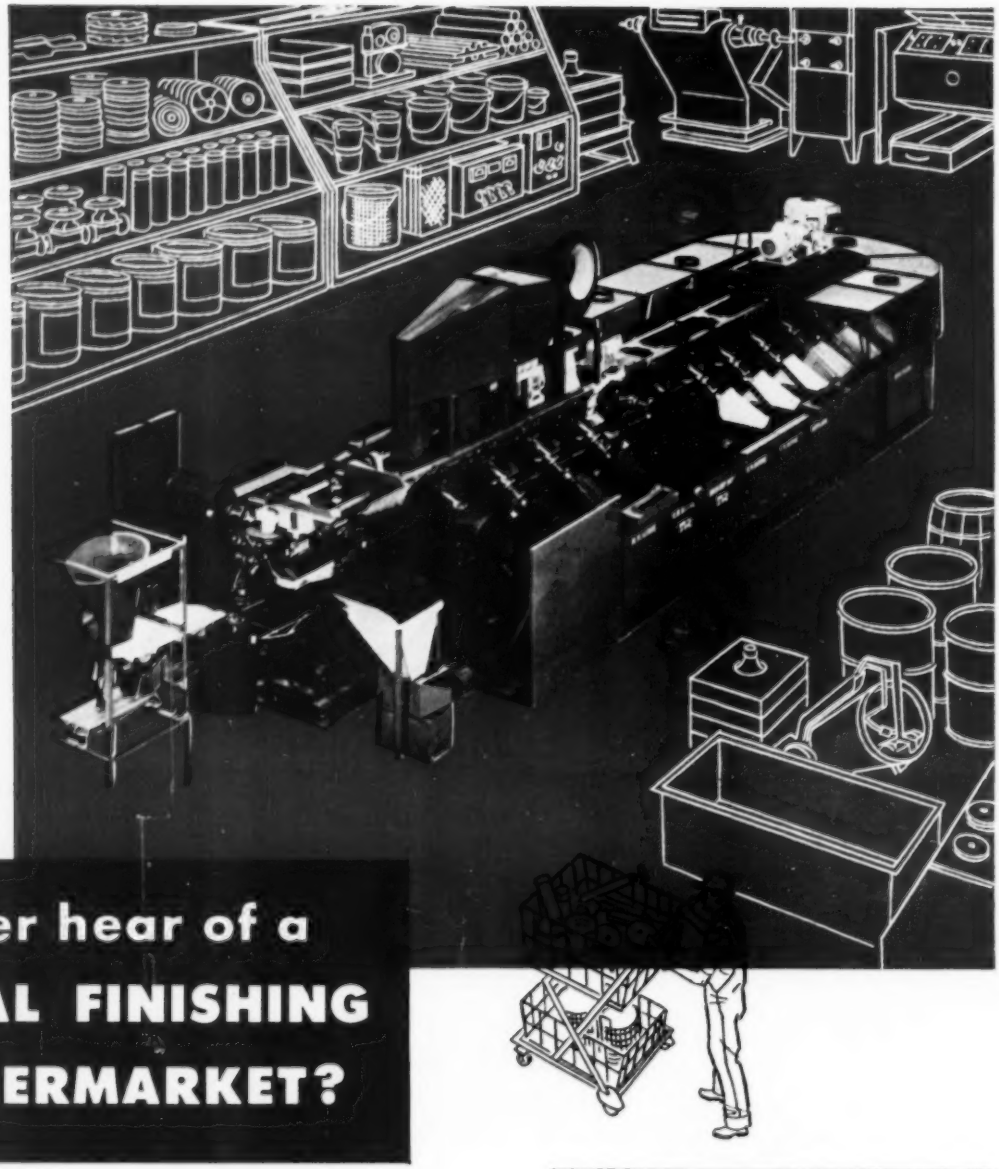

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JULY, 1954 VOL. 41, NO. 7



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# Editorial

## Fourth International Conference on Electrodeposition and Metal Finishing

London, England
April 20–24, 1954

The American Electroplaters' Society can be proud of its contributions and co-operation with the Institute of Metal Finishing in participating at the Fourth International Conference on Electrodeposition and Metal Finishing. This Conference was truly an international meeting with twelve countries represented. Our Society had nearly a score of representatives in attendance.

Of the thirty-two papers delivered at the Conference, sixteen were presented by American authors. Most of the American authors are active members of the AES. The Conference included three and one-half days of technical sessions with over five hundred in attendance, and three evenings of gracious and impressive English hospitality which never will be forgotten by those who attended.

The technical sessions were not only extremely interesting but profitable as well. These excellent technical contributions, together with their discussions, will be available as a bound volume of the Institute of Metal Finishing by late summer. I would recommend this volume as a worthwhile addition to your electrodeposition library. Elsewhere in this issue you will find the details for the purchase of this volume at a special price for AES members.

As we congratulate our English associates on a very successful conference, the plans for the Fifth International Conference in 1958 or 1959 are under consideration. It would be fitting if the next meeting could be held in the U. S. A.

Ralph A. Schaefer

AES First Vice-President

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# VOLTAGE AND CURRENT FLUCTUATIONS IN THE OUTPUT OF PLATING RECTIFIERS

BY V. L. RICHARDS*

## Introduction

The purpose of this paper is to present data on voltage and current fluctuations in the output of selenium plating rectifiers.

In a conventional d-c voltmeter or ammeter, the voltage or current is indicated by the movement of a relatively heavy needle across the face of the meter. These meters purposely are built to show a steady average reading even though the values of voltage or current may be fluctuating rapidly over wide limits.

## Oscilloscope Studies

In order to study the magnitude of these rapidly changing values, the author has used an oscilloscope. In this instrument a beam of electrons is used to measure voltage, and since it has no weight it can respond to extremely fast changes in voltage.

This beam is deflected vertically in proportion to the voltage applied to the instrument. The beam of light also moves horizontally across the face of the cathode ray tube at a controlled rate of speed: when it reaches the right hand side of the tube it is "blanked out" and immediately starts again at the left hand side and repeats its movement. If the beam is adjusted to move across the tube in exactly the same time as a repetitive cycle of voltage, successive paths of the beam are superimposed. In this way a stationary figure appears on the tube which is in effect a graph showing instantaneous values of voltage versus time, voltages being read on a vertical scale and time on a horizontal scale.

### *Batteries vs. Single-Phase Rectifiers*

Figs. 1 and 2 show very dramatically the inability of a conventional voltmeter to give any indication of voltage fluctuations.

Fig. 1 shows the output of a storage battery. The voltmeter reads 6 and the oscilloscope shows that 6 volts are delivered continuously.

In Fig. 2, the d-c voltmeter also reads 6, but the source of the voltage is a single-phase, full-wave plating rectifier. The oscilloscope shows that this rectifier

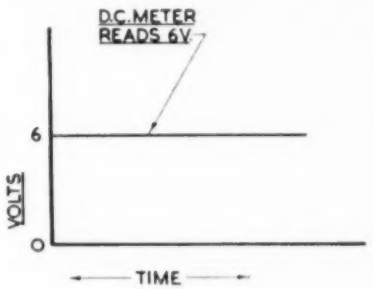


*Fig. 1. Battery*

delivers a pulsating voltage which fluctuates from zero to 9.4 volts and back to zero twice per cycle, or 120 times per second.

### *Three-Phase Rectifiers*

A three-phase input is used for all except small plat-

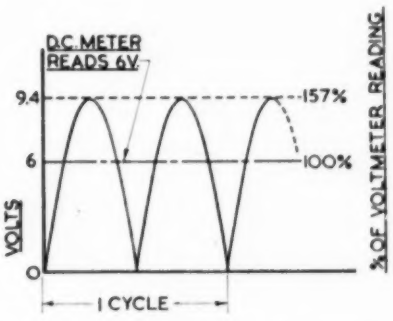


*Fig. 2. Single-phase, full-wave, rectifier —2 ripples per cycle*

*Works Manager, Canadian Hanson & Van Winkle Co. Ltd., Toronto, Ontario, Canada.

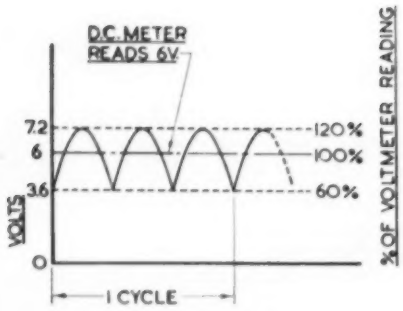


*Fig. 3. Three-phase, half-wave rectifier—3 ripples per cycle—ratio of maximum voltage to minimum voltage of 2:1*

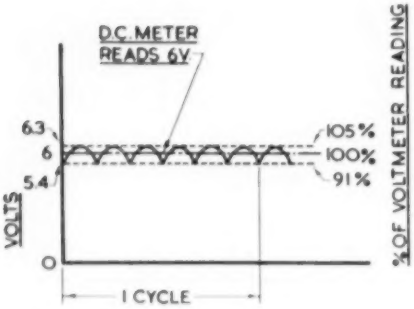


*Fig. 4. Three-phase, full-wave or six-phase, half-wave rectifier—6 ripples per cycle—ratio of maximum voltage to minimum voltage of 1.15:1*

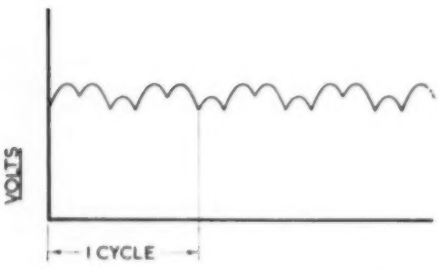


*Fig. 5. Six-phase, half-wave rectifier with tap switches in positions 7-7-8*

ing rectifiers. A number of circuits can be used for three-phase rectifiers but they can be classified into two groups; first, those which produce 3 ripples per cycle, and second, those which produce 6 ripples per cycle.

To illustrate the first group, Fig. 3 shows the output of a three-phase, half-wave rectifier. If the d-c voltmeter reads 6 the rectifier delivers a pulsating voltage which fluctuates from 3.6 to 7.2 volts three times per cycle or 180 times per second. The ratio of maximum to minimum voltage is two to one.

To illustrate the second group, Fig. 4 shows the output of a three-phase, full-wave; three-phase, center tap; or six-phase, half-wave rectifier. If the d-c voltmeter reads 6 the rectifier delivers a pulsating voltage which fluctuates from 6.3 to 5.4 volts six times per cycle or 360 times per second. The ratio of maximum to minimum voltage is 1.15 to 1.

NOTE: All the voltages shown in Figs. 2, 3 and 4 were calculated on the basis of a pure sine wave. All were checked against oscilloscope readings and the correlation between calculated and observed values was quite close. The greatest deviations occurred when three-phase rectifiers were loaded to capacity. Almost always, however, the voltages shown in Figs. 2, 3 and 4 understate rather than overstate the fluctuations.

*Tap-Switch Effects*

Many rectifiers today use a tap switch arrangement which switches one phase at a time. The voltage outputs shown in Figs. 3 and 4 were obtained with all three tap switches on the same number.

Fig. 5 shows the output when one tap switch is in a higher position than the other two, for example, a six-phase, half-wave rectifier in switch positions 7, 7, and 8. It shows that unbalanced tap switch positions produce an unbalanced voltage wave and increase the ratio of maximum to minimum voltages.

The above switching arrangement also breaks one phase at a time in order to maintain partial voltage while the tap switch is being rotated from one position to the next.

The right hand portion of Fig. 6 shows the output of a six-phase, half-wave rectifier (with a wye connected primary winding on the main transformer) when one

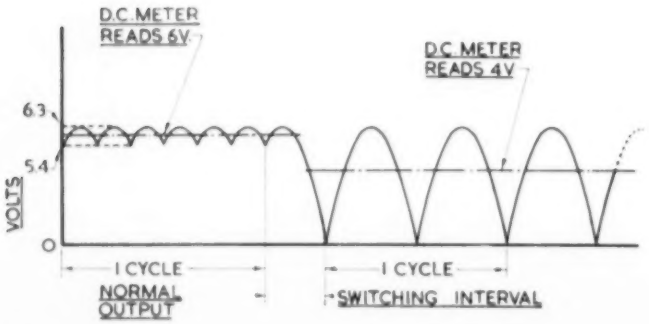


*Fig. 6. Six-phase, half-wave rectifier with wye connected primary*

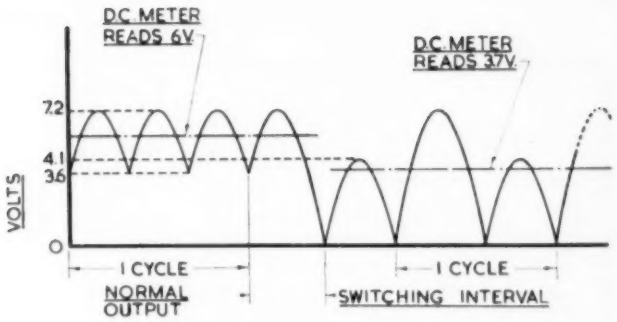


*Fig. 7. Three-phase, half-wave rectifier with Delta connected primary*

tap switch is in the neutral position during the switching interval.

It is exactly similar to a single-phase, full-wave rectifier output having a peak voltage equal to the peak voltage of the six-phase machine.

Similarly a three-phase, half-wave rectifier delivering three ripples per cycle in its normal setting but with a Delta connected primary has an output as shown in the right hand portion of Fig. 7 when one switch is in the neutral position during the switching interval. This curve is somewhat similar to a single-phase, full-wave output except that one peak per cycle is as high as the peak voltage of the original three-phase, half-wave machine but the other peak is only a little more than half as high.

The duration of these switching intervals is short, but in some plating processes it is important to realize that if the tap switches are rotated while the work is plating a three-phase or six-phase rectifier momentarily acts as a single-phase rectifier.

*Internal Failure Effects*

Furthermore, poor internal connections or failure of some portions of the rectifier also can give rise to abnormal fluctuations of voltage.

As a specific example, a three-phase, half-wave rectifier recently was sent to the author's company for repairs. It was a 9-volt rectifier but normally was operated at about 4 volts, on chromium plating. The operator found that the output voltage kept falling so that he had to turn the tap switches higher than formerly. Eventually he found that poor plating resulted—burning on the high current density areas and skipping on the low current density areas.

An oscillograph of the output of this rectifier is shown in Fig. 8. This pattern was caused by the fact that one leg of the stacks had aged excessively. In order to get the same average voltage as before, the rectifier was delivering two pulses of high voltage and one pulse of low voltage per cycle. These abnormal voltage fluctuations prevented a satisfactory chromium deposit.

*Effect of Voltage Fluctuations*

All of the oscillographs in Figs. 2 to 8 were taken with resistance coils acting as the load on the rectifier. Consequently, while they showed values for voltage fluctuations, the current delivered by the rectifier varied in exactly the same proportions. For example, if a single-phase rectifier has a voltage output as shown in Fig. 2, and is connected to a resistance load of such a size that the d-c ammeter reads 100 amperes, the current actually is fluctuating between zero and 157 amperes, 120 times per second.

What happens when the fluctuating voltage of a rectifier is fed to a plating tank? Fig. 9 shows the voltage resulting when a single phase rectifier feeds a still zinc cyanide plating tank under normal operating conditions of solution composition, temperature, current density, etc.

At a cathode current density of 30 amps/sq ft, the voltmeter read 5.7 volts. The oscilloscope showed a peak voltage of 7.5 but instead of going down to zero,

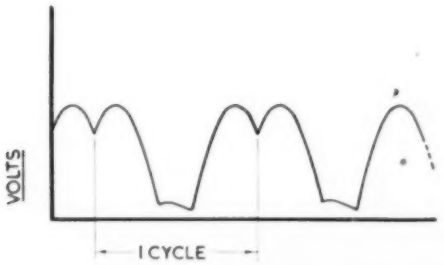


*Fig. 8. Three-phase, half-wave rectifier; stacks on one leg aged excessively*

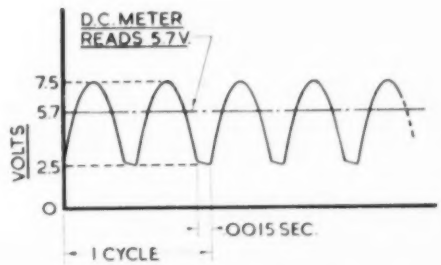


*Fig. 9. Single-phase, full-wave rectifier feeding cyanide zinc tank*

TABLE I. SINGLE-PHASE RECTIFIER FEEDING PLATING TANK

| Solution | Cyanide Zinc | Acid Copper | Bright Nickel | Chromium | Cadmium | High Speed Copper | Stannate Tin |
|---|---|---|---|---|---|---|---|
| Amps per sq ft (Cathode) | 30 | 28 | 30 | 150 | 25 | 20 | 30 |
| d-c Voltmeter | 5.7 | 1.4 | 3.6 | 5.4 | 3.0 | 1.7 | 4.9 |
| Max. Volts | 7.5 | 2.35 | 5.5 | 7.0 | 5.0 | 2.6 | 7.0 |
| Min. Volts | 2.5 | 0.05 | 0.7 | 2.5 | 1.0 | 0.9 | 2.6 |

the voltage flattened out at 2.5 volts: (as in Fig. 2, these fluctuations occurred 120 times per second).

The author's explanation is that polarization at the anode and cathode develops a back emf which opposes or bucks the rectifier. After the rectifier voltage drops below the polarization voltage of the zinc plating tank, it is this back emf which registers on the oscilloscope. Similarly this explains why a voltage reading appears on a tank voltmeter when the plating current is interrupted.

If the plating current is interrupted while the zinc plating tank is connected to the oscilloscope, this back emf appears as a horizontal line similar to that of Fig. 1, but of a smaller magnitude, and it decreases in value, quite rapidly.

Similar tests were run on a number of plating solutions and the voltage curves looked substantially the same—the chief difference being in the values of the polarization voltage.

Typical results are given in Table I.

All of the foregoing oscillographs have shown rectifier output voltage. What happens when one measures current? Even though the oscilloscope reads voltage one can alter the scale of magnification and read the voltage drop across a shunt. In this way one can measure current, just as a d-c ammeter reads the millivolt drop across a 50 millivolt shunt.

Fig. 10 shows the current flowing when a single-phase, full-wave rectifier feeds a still cyanide zinc tank. (These current readings were taken simultaneously with the voltage readings shown in Fig. 9.)

The significance of this curve is that with an ammeter reading of 30 amperes there is a current fluctuation from 60 to zero amperes, 120 times per cycle. Furthermore, these periods during which no current flows are approximately 0.0015 second long, and since they occur 120 times per second, no current flows for approximately 18 per cent of the time.

Similar current readings were made on other plating tanks. The current interruptions in some cases were so short as to be scarcely measurable (shown as "nil" in Table II), and others had a duration up to 0.0015 second.

Typical results are given in Table II.

The explanation of these periods of current interruption is that whenever the rectifier voltage drops below the back emf of the plating tank it can no longer force current through the tank. No current flows until the rising voltage of the rectifier wave once again exceeds the back emf of the tank, at which point current again begins to flow into the zinc tank.

*Battery Effect in a Zinc Solution*

It is interesting to note that plating tanks, such as zinc, have some of the characteristics of a storage battery. The electrical capacity is extremely small, how-

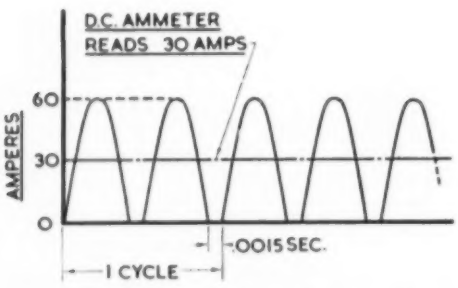


*Fig. 10. Single-phase, full-wave rectifier feeding cyanide zinc tank*

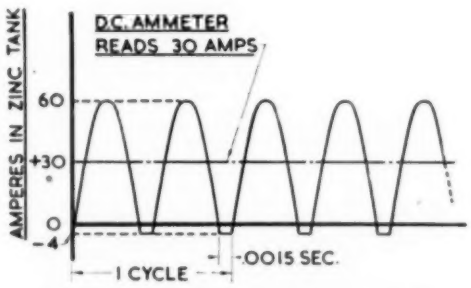


*Fig. 11. Single-phase, full-wave rectifier feeding cyanide tank and resistor in parallel*

TABLE II. SINGLE-PHASE RECTIFIER FEEDING PLATING TANKS

| Solution | Cyanide Zinc | Acid Copper | Bright Nickel | Chromium | Cadmium | High Speed Copper | Stannate Tin |
|---|---|---|---|---|---|---|---|
| Cathode Amps/sq ft (by Ammeter) | 30 | 28 | 30 | 150 | 25 | 20 | 30 |
| Max. Current Density | 60 | 47 | 52 | 223 | 43 | 36 | 60 |
| Length of Current Interruptions (Seconds) | 0.0015 | Nil | 0.001 | 0.0015 | 0.001 | 0.0012 | 0.0015 |
| Per cent of time during which no current flows | 18 | Nil | 12 | 18 | 12 | 14.4 | 18 |

ever, since the back emf presumably is caused by surface phenomena, which dissipate quickly when the plating current stops.

This "battery effect" was shown in the following experiment. A zinc tank and a resistor were connected in parallel across a single-phase rectifier. Voltage across the zinc tank and current through the zinc tank were measured by the same techniques used previously and the results were as shown in Table III and plotted in Fig. 11.

The voltage curve is similar in shape to Fig. 9. The most interesting feature of the current curve is the fact that there is a reverse current of 4 amperes, which flows for 0.0015 second, 120 times per second.

The complete set of voltage and current readings for the zinc tank and resistor in parallel across a single-phase rectifier are shown in the left hand column of Table III. The right hand column shows similar readings on the same zinc tank with the same current as before but without the resistor in parallel.

In both the tests shown above, the minimum voltage shown on the oscilloscope represents the polarization voltage of the zinc tank. When the resistor is connected across the tank and when the rectifier voltage drops below the zinc tank polarization voltage, current flows from the zinc tank through the resistor. This reverse current caused by the "battery effect" of the zinc tank causes some depolarization as shown by the fact that the minimum voltage with the resistor in parallel is 2.1 volts as against 2.3 volts for the zinc tank alone.

A similar reversal of current in a zinc tank was

TABLE III. SINGLE-PHASE RECTIFIER FEEDING ZINC TANK

| | | Zinc Tank and Resistor in parallel across single-phase rectifier | Zinc Tank across single-phase rectifier |
|---|---|---|---|
| Voltage Across Zinc Tank | By Voltmeter | 4.65 volts | 4.55 volts |
| | By Oscilloscope (a) Maximum | 7.5 volts | 7.0 volts |
| | (b) Minimum | 2.1 volts | 2.3 volts |
| Current in Zinc Tank | By Ammeter | 30 amperes | 30 amperes |
| | By Oscilloscope (a) Maximum | 60 amperes | 57 amperes |
| | (b) Minimum | 4 amperes reverse | Zero |

TABLE IV. THREE-PHASE, HALF-WAVE RECTIFIER FEEDING ZINC TANK

| | | |
|---|---|---|
| By d-c Voltmeter | Tank Voltage | 5.5 |
| By Oscilloscope | Max. Tank Voltage | 6.7 |
| | Min. Tank Voltage | 3.5 |
| | Ratio Max. Voltage / Min. Voltage | 1.9 / 1 |
| By d-c Ammeter | Tank Current Density | 40 amps/sq ft |
| By Oscilloscope | Max. Current Density | 58 amps/sq ft |
| | Min. Current Density | 15.5 amps/sq ft |
| | Ratio Max. Current Density / Min. Current Density | 3.7 / 1 |

observed when a cyanide zinc tank (with a high polraization voltage) was paralleled with a nickel tank (with a low polarization voltage).

One further set of experiments on a single-phase rectifier feeding a zinc tank may be of interest. If a zinc probe is placed between the anode and cathode, and the oscilloscope connected across the probe and the anode, the voltage curve appears somewhat similar to Fig. 9 but the values are lower.

The minimum voltage here represents the anode polarization instead of the combined anode and cathode polarization which appeared in Fig. 9. Unlike a Haring Cell, the location of the probe does not affect the minimum voltage reading, since during the interval of minimum voltage no current flows and therefore there is no IR drop.

This technique was not pursued in detail but it might be of value as a means of comparing the effect of different addition agents and brighteners on anode and cathode polarization.

The next experiments consisted of connecting a three-phase, half-wave rectifier across a cyanide zinc still plating tank. Simultaneous readings were made by d-c meters and by the oscilloscope of the voltage across the tank rods and of the current flowing in the tank. The results obtained are shown in Table IV.

These data are plotted in Fig. 12 which shows, on a common time base, the instantaneous values of voltage across the zinc tank and current in the zinc tank. The voltage fluctuations are in substantially the same proportions as in Fig. 3, namely the highest voltage is approximately 1.9 times the lowest voltage.

The current fluctuations are much larger than the voltage fluctuations, the maximum current being approximately 3.7 times the minimum current.

Similar experiments were conducted by feeding other plating tanks with a three-phase, half-wave rectifier and reading fluctuations of current and voltage in the tank. Some of these results are summarized in Table V.

The conclusion to be drawn from these readings is that when a fluctuating voltage is fed to a plating tank, the current fluctuations are in many cases magnified.

The cause of this situation is the presence of a polarization voltage or back emf in many types of plating tanks. The total voltage drop across a plating tank is the sum of the polarization voltage and the IR drop or resistance loss of the solution. Of the total voltage across the tank only that portion which exceeds the polarization voltage is effective in forcing current

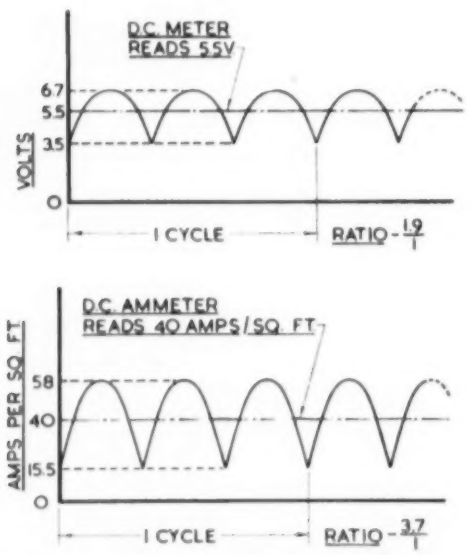


*Fig. 12. Three-phase, half-wave rectifier feeding cyanide zinc tank*

TABLE V. THREE-PHASE, HALF-WAVE RECTIFIER FEEDING PLATING TANKS

| Solution | Cyanide Zinc | High Speed Copper | Cadmium | Bright Nickel | Stannate Tin | Chromium | Acid Copper |
|---|---|---|---|---|---|---|---|
| Amps/sq ft | 40 | 45 | 30 | 32 | 32 | 88 | 25 |
| Ratio: Max. Volts | 1.9 | 1.54 | 2.35 | 2.11 | 1.55 | 1.62 | 2.3 |
| Min. Volts | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Ratio: Max. Amps. | 3.7 | 4.0 | 3.24 | 2.64 | 2.50 | 2.23 | 2.4 |
| Min. Amps. | 1 | 1 | 1 | 1 | 1 | 1 | 1 |

TABLE VI. SIX-PHASE, HALF-WAVE RECTIFIER FEEDING PLATING TANKS

| Solution | Cyanide Zinc | High Speed Copper | Cadmium | Bright Nickel | Stannate Tin | Chromium |
|---|---|---|---|---|---|---|
| Amps/sq ft | 35 | 32 | 30 | 38 | 34 | 115 |
| Max. Volts | 1.15 | 1.17 | 1.18 | 1.15 | 1.16 | 1.13 |
| Min. Volts | 1 | 1 | 1 | 1 | 1 | 1 |
| Ratio: Max. Amps. | 1.26 | 1.28 | 1.20 | 1.25 | 1.20 | 1.30 |
| Min. Amps. | 1 | 1 | 1 | 1 | 1 | 1 |

through the tank. This can be expressed mathematically as follows:

$$\frac{\text{Current (A)}}{\text{Current (B)}} = \frac{\text{Tank Voltage (A)} - \text{Polarization Voltage (A)}}{\text{Tank Voltage (B)} - \text{Polarization Voltage (B)}}$$

To take an elementary example: If the tank voltage A is 4 volts and tank voltage B is 2 volts and the polarization voltage for this solution during the above conditions is 1.2 volts and 1.0 volts respectively, current A will be $\frac{4 - 1.2}{2 - 1.0}$ or 2.8 times that of current B, even though the voltage at A is only twice that of B.

The total voltage output of the rectifier is dissipated in three ways:

(a) Polarization voltage (if present)
(b) Resistance losses in bus bars
(c) Resistance loss in plating tank

Electrically all resistance losses can be grouped since their effect is identical.

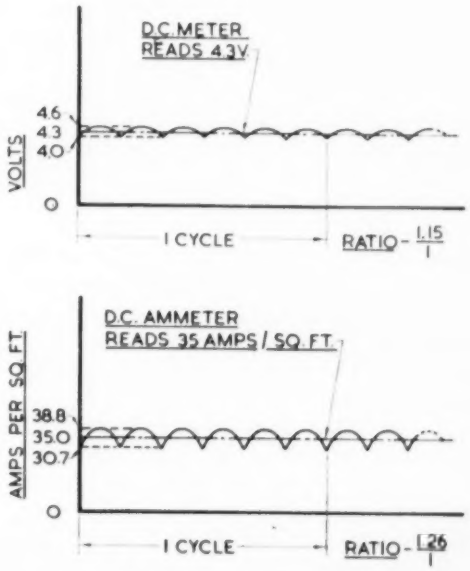


*Fig. 13. Six-phase, half-wave rectifier feeding cyanide zinc tank*

TABLE VII. CHROMIUM TANK FED BY THREE-PHASE, HALF-WAVE AND SIX-PHASE, HALF-WAVE RECTIFIERS

| | | Three-phase, Half-wave | Six-phase, Half-wave |
|---|---|---|---|
| By d-c Voltmeter | Tank Voltage | 6.75 | 8.7 |
| By Oscilloscope | Max. Tank Voltage | 7.1 | 9.1 |
| | Min. Tank Voltage | 4.4 | 8.0 |
| | Ratio: Max. Tank Voltage / Min. Tank Voltage | 1.62 / 1 | 1.135 / 1 |
| By d-c Ammeter | Current | 175 amperes | 225 amperes |
| By Oscilloscope | Max. Current | 206 amperes | 244 amperes |
| | Min. Current | 92 amperes | 187 amperes |
| | Ratio: Max. Current / Min. Current | 2.23 / 1 | 1.30 / 1 |

If the polarization voltage represents a large portion of the total voltage drop, the current fluctuations will be "magnified" to a much greater degree than if the polarization voltage represents only a small portion of the total voltage.

It will be recalled that for a three-phase, half-wave rectifier, the ratio of maximum to minimum voltage was shown in Fig. 3 to be 2:1. Table V shows some ratios both higher and lower than this. This is due to two factors:

(1) The ratio of maximum to minimum voltage varies with the percentage load on the rectifier.

(2) IR drop in the bus bar between the rectifier and the plating tank reduced the peak voltage more than it reduced the minimum voltage; thus the ratio of maximum to minimum voltage measured at the plating tank is less than when measured at the rectifier.

*Experimental Studies with Six-Phase Rectifiers*

Similar experiments were carried out by applying current from a six-phase, half-wave rectifier to a series of plating tanks and simultaneous readings of tank voltages and currents were made. Some of these results are given in Table VI and one set of figures is plotted in Fig. 13.

An examination of these figures shows that a six-phase, half-wave rectifier produces voltage and current with much smaller fluctuations than do the three-phase, half-wave rectifier.

As before, the current fluctuations are influenced both by the voltage fluctuations and by the polarization voltage. Not only are the voltage fluctuations much smaller, but the minimum rectifier voltage is much farther above the polarization voltage; both of these factors cause the current fluctuations to be much less than in the former experiments with a three-phase, half-wave rectifier.

Particular attention is called to readings given in Table VII that were taken on a chromium tank, fed by a six-phase, half-wave rectifier, as compared with the readings taken on the same tank fed by a three-phase, half-wave rectifier.

This leads to a word of caution when interpreting rectifier advertisements. The ripple of a three-phase, half-wave rectifier is calculated by NEMA Standards as 18.4 per cent. This method of calculation has no direct relationship with the factors which apply to plating, and in fact this figure is very misleading. As shown above a rectifier with a so-called ripple of 18.4 per cent actually has a ratio of maximum to minimum voltage of 2 to 1, and may produce in a plating tank a current varying in the ratio of 4.0 to 1.

Similarly the three-phase, full-wave or six-phase, half wave rectifiers have a calculated value of 5 per cent (by NEMA Standards) yet the ratio of maximum to minimum voltage is 1.15 to 1 and the ratio of maximum to minimum current may be 1.30 to 1.

## Summary

The first part of this paper showed the magnitude of voltage fluctuations in the output of plating rectifiers.

The second portion showed that whenever polarization voltages existed in a plating tank, current fluctuations were affected both by voltage fluctuations and these polarization voltages.

More specifically whenever a fluctuating rectifier voltage dropped below the polarization voltage (as in

a single-phase rectifier) the current remained at zero for appreciable intervals instead of hitting zero and "bouncing" back instantaneously.

When the fluctuating rectifier voltage remained above the polarization voltage the current fluctuations were greater than the voltage fluctuations. This "magnification" effect was greatest where the polarization voltage approached the lowest value of the fluctuating rectifier output.

What are the practical applications of these facts?

This particular project was undertaken for a study of product quality by a rectifier manufacturer. It showed the effect of the plating bath on the current fluctuations in the output of a rectifier. A study of the effect of these current fluctuations on the quality of the plate is outside the scope of this paper.

It is hoped, however, that this concept of current output from rectifiers may be of value to those buying rectifiers, operating plating tanks from rectifiers, or those doing development work on plating solutions.

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# ANALYTICAL DETERMINATION OF TRACE CONSTITUENTS IN METAL FINISHING EFFLUENTS

## V. THE COLORIMETRIC DETERMINATION OF NICKEL IN EFFLUENTS

BY DONALD G. GARDNER,* EARL J. SERFASS† AND RALPH F. MURACA†

*The following paper, the fifth of a series, is a result of the work sponsored at Lehigh University by the AES and the Ohio River Valley Water Sanitation Commission. While the original procedure was worked out under AES sponsorship, the modification was developed under ORSANCO sponsorship, the commission having placed the project at Lehigh so as to be able to utilize the background developed by AES Project No. 2. It should be noted that the methods described in this series were tested, modified if necessary, and retested by at least six and sometimes as many as twelve industrial laboratories. As a result of this, the approved form, as published here, was developed.*


### Abstract

A colorimetric procedure for the determination of 5 to 50 ppm of nickel in effluents is presented. The method was found to yield satisfactory results in the presence of as much as 5,000 ppm of each of 23 cations in simultaneous admixture as well as in the presence of organic materials.

The method makes use of a treatment with hot, concentrated acids to remove organic matter and an extraction of the nickel content of the sample as the dimethylglyoxime complex with chloroform. The intensity of the color of the nickel dimethylglyoxime complex is measured with a colorimeter after its extraction from the chloroform solution.

The procedure can be shortened materially if the content of the individual metals which are present is below 15 ppm. A table summarizes the changes which can be made when the amounts of the elements other than nickel are known or can be estimated.


### The Colorimetric Determination of Nickel in Effluents

The commonly used method for the colorimetric determination of nickel depends upon the formation of the red colored complex of nickel (II) dimethylglyoxime. Nickel (II) dimethylglyoxime is soluble in chloroform and this serves as the method of separating minute amounts of nickel from large quantities of other elements. Although copper also is extracted to some extent, it can be removed from the chloroform solution by washing with a dilute solution of ammonia. Of the usual elements which are likely to be present, only cobalt forms a complex with dimethylglyoxime. Fortunately, the cobalt complex is not soluble in chloroform to a significant extent, although large amounts of cobalt interfere by consuming reagent.

Since manganese may interfere with the extraction of nickel (II) dimethylglyoxime by oxidizing it to nickelic (IV) dimethylglyoxime, which is insoluble in chloroform, a reducing agent such as hydroxylamine hydrochloride is added to keep manganese in the divalent state.

#### *Description of the Method*

A preliminary fuming with nitric and sulfuric acids is carried out to decompose organic matter which may retain nickel in a form which will not react with dimethylglyoxime. Insoluble substances which remain after dilution of the digestion mixture are removed by filtration or centrifugation.

The diluted digestion mixture is treated with hydroxylamine hydrochloride and then made ammoniacal in the presence of citrate. After the addition of a solution of dimethylglyoxime, the nickel complex is extracted with chloroform. The chloroform layer then is washed with a dilute solution of ammonia to remove copper. The nickel (II) dimethylglyoxime complex which is in the chloroform layer is removed by wash-

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ing with a dilute solution of hydrochloric acid. The acid solution of nickel dimethylglyoxime complex is treated with bromine water to oxidize the nickel and then made ammoniacal; the nickel (IV) dimethylglyoxime complex which forms has a very intense brown to red color[1]. The full intensity of the color is developed almost immediately and is stable for about 15 minutes. However, it increases slowly on long standing and eventually fades.[2] The intensity of the color of the nickel (IV) dimethyglyoxime complex follows Beer's law up to about 100 ppm. The developed color is measured at 525 millimicrons on a spectrophotometer or with a green filter on a colorimeter.

The recommended procedure was found to yield excellent results for 5 to 50 ppm of nickel in solutions containing 5,000 ppm of each of the following ions in simultaneous admixture: $Ag^{+}$, $Hg^{++}$, $Pb^{++}$, $Bi^{+++}$, $Cu^{++}$, $Cd^{++}$, $As^{+++}$, $Sb^{+++}$, $Sn^{++}$, $Al^{+++}$, $Cr^{+++}$, $Fe^{+++}$, $Mn^{++}$, $Co^{++}$, $Zn^{++}$, $Ca^{++}$, $Sr^{++}$, $Ba^{++}$, $Mg^{++}$, $Na^{+}$, $K^{+}$, $NH_4^{+}$, P as $PO_4^{---}$, and organic materials such as tartrates. The valence state of the ions in the sample is of no concern because of the action of nitric acid during the fuming step.

*Sensitivity of the Method*

The sensitivity of the method is defined as the number of micrograms of nickel which can be determined with a relative error of ±50 per cent. For the following recommended procedure this corresponds to 5 ppm or 100 micrograms of nickel in the 20-ml sample taken for analysis.

*Limit of Detection of the Method*

The limit of detection of the method is defined as the number of micrograms of nickel which must be present in the 20-ml sample taken for analysis so that an extinction of 0.005 will be obtained in Step 16 for a 1-cm cell thickness at 525 millimicrons. This corresponds to 20 micrograms of nickel (1 ppm) for the recommended procedure.

The limit of detection can be increased by taking a larger sample, provided that the concentration of each of the other elements remains below 5,000 ppm.

*Discussion of the Blank*

A blank is used to compensate for the presence of traces of nickel in the reagents.

*Recommended Procedure*

This procedure is designed to be used for the determination of 5 to 50 ppm of nickel in a 20-ml sample of effluent.

*Reagents Required*

(1) Nitric acid—Concentrated, 16N; reagent grade.
(2) Sulfuric acid—36N; reagent grade.
(3) Ammonium hydroxide—Concentrated 15N; reagent grade.
(4) Hydroxylamine hydrochloride solution—10 per cent w/v.
(5) Sodium citrate solution—10 per cent w/v.
(6) Dimethylglyoxime solution—1 per cent w/v in alcohol.
(7) Ammonium hydroxide solution—1:50.
(8) Hydrochloric acid solution—0.5N.
(9) Bromine water—saturated (5 ml cp bromine plus 100 ml of water).
(10) Chloroform—Reagent grade.
(11) Standard nickel solution—Dissolve 0.448 gram of reagent grade nickel sulfate—($NiSO_4.6H_2O$) in distilled water and dilute to one liter.

1 ml = 100 micrograms of nickel

For establishing a calibration curve, 1 ml of this solution taken as a sample corresponds to 5 ppm of nickel for a 20-ml sample of effluent taken for analysis in step 1 of the recommended procedure.

*Procedure*

(1) Pipette a 20-ml sample of the effluent into a 150-ml beaker.
In running a blank, use 20 ml of water.
In establishing a calibration curve, use 20 ml of water and add 1 ml of the standard nickel solution for each 5 ppm of nickel.
(2) Evaporate the solution to a small volume, but not to dryness.
Add 5 ml of concentrated nitric acid and evaporate to dryness, but do not bake.
Cool and add 5 ml of concentrated nitric acid followed by 2 ml of concentrated sulfuric acid. Evaporate to strong fumes of sulfur trioxide. Gently fume for 5 minutes.
If the residue after fuming is discolored by carbon, cautiously add 2 ml of concentrated nitric acid and fume again. Repeat as many times as is necessary. It may be necessary to add more concentrated sulfuric acid to prevent the mixture from going to dryness.
(3) Cool to room temperature. Add 50 ml of water, stir, and let stand for a few minutes.
(4) Filter the solution, if necessary, through a medium porosity sintered glass funnel, saving the filtrate. If possible, use a centrifuge.
Wash the filter at least three times with 5-ml portions of water. Combine the washings and filtrate.
(5) Transfer the filtrate and washings to a 100-ml volumetric flask and dilute to the mark with water.
(6) Pipette 20 ml of the solution into a separatory funnel.
Add 5 ml of hydroxylamine hydrochloride solution; shake well. A precipitate may form.
(7) Add 10 ml of sodium citrate solution; shake well. Now add concentrated ammonium hydroxide until the solution is definitely ammoniacal; shake well.
Add 5 ml of dimethylglyoxime solution; shake well.

TABLE I. SUMMARY OF CHANGES OF RECOMMENDED PROCEDURE WHEN SAMPLE COMPOSITION IS KNOWN

| Composition of Effluent | Changes in the Recommended Procedure |
|---|---|
| Organic matter absent | Omit steps 1 to 5 inclusive. Take a 4-ml sample of the effluent, and start with step 6 of the recommended procedure. |
| Organic matter absent; all elements except nickel below 15 ppm | Pipette 4 ml of the effluent into a 100-ml volumetric flask, add 5 ml of 0.5 N HCl, and then add bromine water, dropwise, until the solution is straw-yellow in color. Add 5 ml of 10 per cent sodium citrate solution and then add ammonium hydroxide until the solution is ammoniacal and any precipitate which may have formed is redissolved. Follow the recommended procedure starting with step 14. |
| Organic matter absent; cobalt, iron, copper, manganese, and chromium below 100 ppm; all other elements below 5000 ppm | Follow the above procedure adding 5 ml of hydroxylamine hydrochloride solution and 10 ml of sodium citrate solution.<br><br>For a blank, use 4 ml of the effluent but do not add dimethylglyoxime in step 14. The blank obtained in this way will be somewhat in error due to the lack of coloration which dimethylglyoxime develops with certain other elements. However, this error will be within the limits of ±50 per cent in the range of 5 ppm of nickel and ±10 per cent in the 50 ppm range. |
| Manganese less than 15 ppm | Omit the addition of hydroxylamine hydrochloride solution from the recommended or shortened procedures. |
| Organic matter present; iron, cobalt, copper, chromium, and manganese greater than 100 ppm, but less than 5000 ppm | Follow the recommended procedure. |

(8) Extract the solution with three separate portions of 5 ml of chloroform, each time shaking for at least one minute. Save the chloroform layers.

(9) Wash the chloroform extract with one 10-ml portion of 1:50 ammonium hydroxide. Shake for at least one minute; save both liquid layers.

(10) Extract the ammoniacal layer with one 5-ml portion of chloroform. Combine the chloroform extracts and reject the aqueous layer.

(11) Shake the chloroform with 5 ml of 0.5 N HCl. Pour off the chloroform into a separatory funnel; save the HCl by draining it into a 100-ml volumetric flask. Wash the separatory funnel, which contained the acid layer, with a little water; these washings are united with the HCl in the volumetric flask.

(12) Repeat step 11. This time discard the chloroform.

(13) Add 15 drops of saturated bromine water to the contents of the volumetric flask. Add concentrated ammonium hydroxide until the bromine color is destroyed and then add 4 or 5 drops in excess.

(14) Add 1 ml of 1 per cent dimethylglyoxime solution.
Bring to the mark with water. Shake well.

(15) Set the colorimeter to zero with water. Use a green (No. 54) filter. With a spectrophotometer, set the instrument to read full scale at 525 millimicrons.

(16) Transfer the solution from step 14 to the sample cuvette and read the colorimeter *within 15 minutes.*

(17) If necessary, convert the scale readings of the photometer to optical density. Subtract the blank reading from the sample reading. If a calibration curve is being established, plot these corrected readings versus ppm of nickel. If a sample is being run, read the amount of nickel from the calibration curve.

*Variations of the Recommended Procedure*

If the composition of the effluent is known, the recommended procedure can be altered to suit particular samples. In general, the procedure will be shortened materially if the concentration of cobalt, copper, chromium, iron, and manganese are below 15 ppm each.

Table I summarizes the changes which can be made in the recommended procedure when the composition of the sample is known. Unless otherwise stated, the concentrations of other elements must not exceed 5,000 ppm. For effluents containing greater quantities of these elements, dilution will be necessary. The effluent should be acidic or neutral.

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[2]E. B. Sandell, "Colorimetric Determination of Traces of Metals," 1st ed., pp. 339-345, Interscience Publishers, Inc., New York, 1944.

# PLATING APPLICATIONS IN THE TELEVISION FIELD

BY LEONARD P. FOX*

SYNOPSIS

*This article describes some unusual plating applications used in the production of electron tubes for the television field. The plating applications described are used primarily for functional purposes rather than for the sake of appearance. Special care is taken to exclude contamination from plated coatings used on the interior surfaces of tubes because very small amounts of contaminants may impair the life or performance of the tubes. Care also is taken to insure uniformity of thickness, especially in tubes in which glass-to-metal seals are used. Among the processes described is the plating of fine mesh screens for use in television camera tubes.*

## INTRODUCTION

Electroplating of tube parts at the plant of the author's employer accomplishes such functional objectives as increasing surface conductivity or increasing corrosion resistance or preparing parts for brazing. This paper discusses some unusual applications of plating techniques in the production of tubes for use in television.

Special care must be taken to exclude all impurities from plating baths used for tube parts because the presence of even very small amounts of contaminants in the finished assembly may impair tube life or performance. For example, traces of lead in the order of 0.01 per cent in copper plating salts have been known to cause electrical shorts and poisoning of the cathode in power tubes whose parts were plated in a bath made up with those salts. Lead, like zinc and cadmium, is classified as a relatively volatile material. At the low pressures and high temperatures at which most power tubes operate, these metals volatilize and deposit on the cooler nonconducting portions of the tube.

Because it is so important to prevent contamination, the facilities of a complete analytical laboratory are available to the plating department of the author's plant. All baths are checked for impurities at least once a month by complete chemical analyses and twice a month by spectrographic analysis. If as little as 0.01 per cent of lead, cadmium, or zinc is found to be present in the plating baths, an attempt is made to remove these impurities by means of low current density electrolysis. In some cases (for example, in a gold plating bath) it has been found more economical to recover the plating metal (gold) and make up a fresh bath than to try to remove the metallic contamination. Brighteners used in the bright nickel and silver baths also are checked once a month by means of a Hull-cell test. Most baths are filtered continuously, and all are filtered at least once a week.

Several inspectors are employed full time to check quality and uniformity of thickness of the plating. A magnetic type instrument† is used to measure thickness when magnetic materials are involved. When this instrument is not adaptable, a cross-sectioning method is used.

During the processing of tube parts, the plating must often withstand firing (inert atmosphere heat-treatment) at temperatures as high as 100° C below the melting point of the metal. Because any tendency to peel or blister is readily apparent at these temperatures, variations in the normal cleaning schedules due to substandard materials or carelessness will be revealed immediately. These normal cleaning schedules are the same as at any plating establishment and include alkaline electrocleaning, acid pickling, nickel strike for stainless steel, and several others.

### *Kinescopes*

The general product line at the plant of the author's employer can be broken down into three main fields—kinescopes, pickup tubes and phototubes, and power tubes. The kinescope is the heart of the television set, the tube on which the picture appears. Electroplating

*Tube Division, Radio Corporation of America, Lancaster, Pa.

†Magne-Gage, manufactured by American Instrument Company, Inc., Silver Spring, Md.

*Fig. 1. Aperture hole having a diameter of 0.031 inch before tumbling, magnification 60X*

on kinescopes represents a large volume of the work performed in the plating department, but requires very little variety.

Metal finishing operations on kinescopes are applied only to the stainless steel parts used in the electron gun and comprise tumbling, bright dipping in acid, electropolishing, and some barrel plating with gold. The parts having apertures through which the electron beam is focused, for example, are tumbled after forming to remove burrs. Figs. 1 and 2 show the edges of the aperture before and after tumbling. In different kinescopes, these holes vary in diameter from 0.020 inch to 0.400 inch. A very small burr, of the order of 0.005 inch, on the inside of the hole may be enough to interfere with the focusing of the picture.

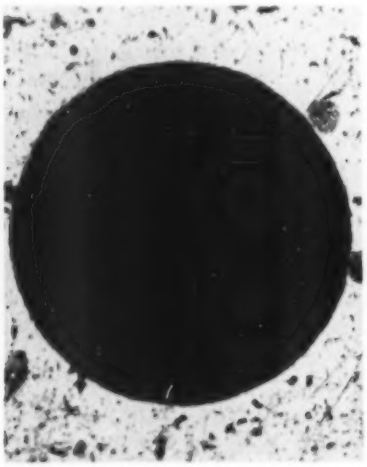

*Fig. 2. Aperture hole having a diameter of 0.031 inch after tumbling, magnification 60X*

After the tumbling operation, the gun parts are either bright dipped in acid or fired in a furnace containing a dry hydrogen atmosphere to remove surface contamination. The dew-point of the hydrogen used is approximately −60° C. Dry hydrogen firing cannot be used on parts which are required to act as supports because the high temperatures (1100° C) tend to recrystallize the metal, and thus anneal or soften it. For some applications, the parts having apertures also are barrel plated with gold to decrease secondary emission. This phenomenon is described later.

In all plating processes on kinescope parts, great care is necessary to exclude impurities from the interior of the tube. The cathode used as an electron emitter in kinescopes is coated with a layer of mixed powdered oxides of barium, strontium, and calcium which is poisoned very easily by slight traces of impurities. As little as 0.5 parts per million of chlorides, for example, may cause slumping emission and poor life in a tube having an oxide coated cathode. When hydrochloric acid pickling or trichlorethylene vapor degreasing is used, therefore, all traces of chlorides must be rinsed from the parts. The rinsing is accomplished usually by agitation of the parts for periods of 5 to 30 minutes in distilled or deionized water. The time required for rinsing depends upon the complexity of the shape of the part.

*Pickup Tubes and Phototubes*

"Pickup" tubes are used in television cameras to pick up the images which are seen on the kinescopes. There are several types of pickup tubes, including the image orthicon, which is used for studio and outdoor pickup, the iconoscope, which is used today mainly for movie pickup, and the vidicon.* The vidicon camera is used in many industries to watch dangerous operations or hard-to-get-at meters, dials, and instruments. Phototubes are included in this general classification because they also contain light-sensitive elements.

The most unique application of plating in television pickup tubes is in the production of fine copper or nickel mesh screens for use in image orthicons and vidicons. These mesh screens are made on a glass master into which two perpendicular sets of grooves have been etched. The number of grooves per inch may be 500 or 1000, depending on the tube type for which the screens are intended. A conductive coating of palladium is sputtered onto the glass master in a vacuum and is then rubbed off the surface of the master to leave a metallic film of palladium in the grooves. The master then is plated in an acid copper plating bath or a bright nickel plating bath, and the plated

*A recent RCA development for small industrial-television cameras.

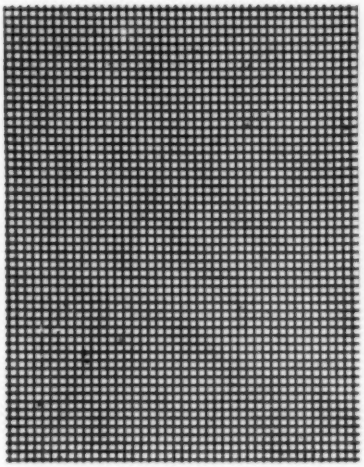

*Fig. 3. 1000-line-per-inch mesh screen, magnification 50X*

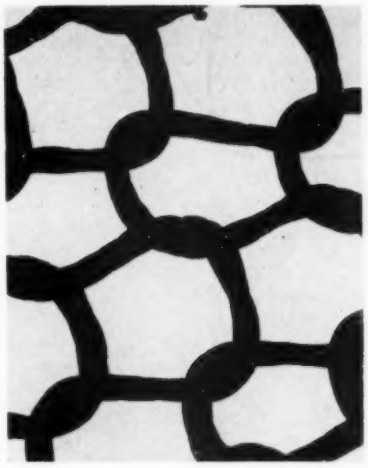

*Fig. 4. Nylon stocking, magnification 50X*

*Fig. 5. Mesh screen ready for mounting in image orthicon*

mesh screen is peeled off and dried. The adherence of the palladium to the glass is adjusted carefully so that the mesh separates easily from the master. The mesh screens are inspected carefully in a dust-free room for holes, tears, and build-up of plating. Because the mesh screen is part of the section of the tube which stores the image until it is picked up by the electron beam, a very small defect in the plating on the screen or a speck of dust on it is magnified many times in the final picture on the receiver kinescope. A defective mesh screen would annoy millions of people watching a television program. Figs. 3, 4, and 5 illustrate the relative fineness of these mesh screens.

Some types of camera tubes and phototubes contain a photosensitive surface which emits electrons when exposed to light. This surface is produced by the evaporation in a vacuum of a film of silver-bismuth alloy, or its equivalent, onto the base metal or glass. The evaporator consists of a platinum plated molybdenum-tungsten alloy wire. When this wire is plated, an attempt is made to obtain a dark, spongy platinum which can be wet easily by the melted alloy immediately prior to evaporation. A smooth platinum surface causes the molten alloy to ball up and fall off.

In addition to the two plating applications described above, the metal portions of the outer surface of some phototubes are plated with a bright nickel alloy to improve corrosion resistance and appearance.

*Power Tubes*

The general classification of power tubes is divided into two groups—large power tubes and small power tubes. The large power tubes are used for radio and television transmission or industrial applications, and the small power tubes for such applications as power supplies of radio and television receivers, mobile radio transmitters, and radar equipment. The plating operations for these tubes constitute the major portion of the work done by the plating department.

The grid wires of many power tubes are plated with platinum, rhodium, or gold to minimize secondary emission. The grid normally is placed between the cathode and the anode of a tube to control the flow of electrons. When a large number of electrons are flowing, some are bound to strike the closely spaced grid wires and cause emission of secondary electrons. The molybdenum wire used for these grids has a high secondary emission characteristic; that is, when bombarded by a primary electron from the cathode, the wire itself can emit many secondary electrons which would interfere with the normal operation of the tube. Plating with platinum, gold, or rhodium changes the secondary emission characteristic of the grid wires and improves the operation of the tubes.

Much plating also is done on large power tubes to increase conductivity both inside and on the surface of the tube. Fig. 6 shows a transmitting triode which is plated with dull silver on the inside and bright silver on the outside. Because most brighteners for silver plating baths contain some form of sulfide, the type of plating from such baths cannot be used inside these tubes. Recent tests[1] with radioactive tracers proved conclusively that a small amount of sulfur as sulfide is coplated with the silver from a bright silver bath. Even this small amount would be enough to impair the operation of the tube.

The plating of external parts of large power tubes such as the triode referred to above presents an interesting problem. After the tube is exhausted (evacuated of air and other gases to a predetermined value) and sealed, it is sent to the plating department for finishing. A typical tube contains glass, which is sensitive to thermal shock, an iron-nickel-cobalt alloy, nickel, cold-rolled steel, brazing alloys, and copper. The cleaning problems prior to plating can be readily appreciated. A previous factory procedure for this type of tube called for a hydrochloric acid pickling process to remove the heat scale produced when the

*Fig. 6. RCA-6161 UHF transmitting tube*

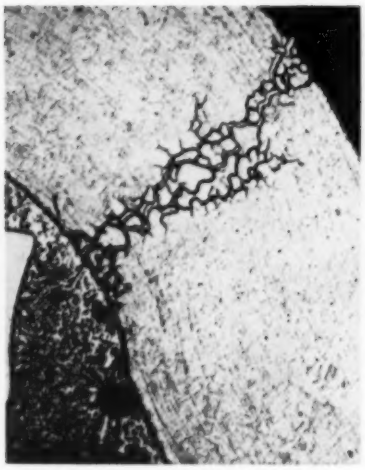

*Fig. 7. Cross section showing penetration of iron-cobalt-nickel alloy by silver solder, magnification 33X*

*Fig. 8. Cross section showing protection afforded by the use of nickel plating on iron-cobalt-nickel alloy, magnification 33X*

glass was sealed to the metal at approximately 1000° C. The use of the pickling process gave excellent plating results, but it was discovered that tubes subjected to this treatment became gassy. Laboratory investigation proved that the hydrochloric acid pickling step caused hydrogen penetration and, subsequently, gassy tubes. All large power tubes now are scratch-brushed to remove heat scale prior to plating. Electrocleaning and a nickel strike complete the present cleaning cycle.

Another case of gassy tubes and cracked metal resulted from the silver brazing of parts made from an iron-cobalt-nickel alloy. Laboratory investigation revealed that silver solder penetrated the grains of the iron-cobalt-nickel alloy, causing cracks in the metal and subsequent leaks. It was discovered that a plated layer of nickel of the order of 0.6 mils (0.0006 inch) would prevent this intergranular penetration during the brazing operation which is performed usually at approximately 800° C. Fig. 7 illustrates the intergranular penetration of the iron-cobalt-nickel alloy by silver solder. Fig. 8 shows the protection afforded by a plated layer of nickel.

*Miscellaneous*

In addition to the processes described above, the plating department performs much electropolishing, electrocleaning of tungsten and molybdenum, and cataphoretic coating of cathodes and filaments.

Electrocleaning is a very efficient process for removing those oxides that are formed when tungsten and molybdenum leads are heat-sealed to glass. Essentially, this process involves the immersion of the parts to be deoxidized in a hot, saturated solution of sodium carbonate and the application of an a-c voltage of approximately 40 volts between the parts and a stainless steel electrode until the parts are completely free of oxides. This cleaning usually takes about one minute depending, of course, upon the depth of the oxide. The process differs from the normal d-c alkaline electrocleaning process designed to remove dirt, grease, and oils prior to electroplating.

Cataphoretic coating of cathodes and filaments is, to some extent, also an electroplating process. When extremely small particles of aluminum oxide or the carbonates of barium, calcium, and strontium are dispersed in an alcohol solution, the particles assume a positive charge. A d-c voltage is impressed between the cathode or filament and an electrode in the mixture so that the positively charged particles migrate and coat the negatively charged cathode or filament. A very dense and adherent coating is obtained in this manner.

## Summary

This article has discussed briefly some of the more unique and unusual plating applications necessary in the production of tubes for television. Many precautions are taken in these applications to prevent contamination from entering the tubes. Most of the plating processes are performed for some necessary reason, and not primarily for appearance. It is hoped that this brief discussion may contribute to a better understanding of some of the plating problems facing the television-tube industry.

## Acknowledgment

The author wishes to express his appreciation to Mr. R. H. Zachariason and Dr. G. S. Briggs of the RCA Tube Department for their many helpful suggestions in the preparation of this manuscript.

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# Effect of Surface Finishing of Nonferrous Base Metals on the Protective Value of Plated Coatings

(*Continued from the June, 1954 Issue*)

**project no. 4**

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*AUTHORS

*Barrel Burnishing*

Barrel burnishing was carried out in an oblique twelve-sided wooden barrel. The inside diameter of the barrel was 12 inches at the bottom, 9 inches on top, and it was 12 inches high. The lead in this barrel consisted of brass parts, about 1/8 inch long of cylindrical shape which had been rolled with an $Al_2O_3$ abrasive, then rolled in rottenstone for 48 hours, then bright dipped, and finally burnished in a wooden barrel with a commercial compound. The preparation of these brass parts necessarily was extensive in order to round off the edges. The brass panels were held in the barrel with a fixture which was clamped to the side. The burnishing material in the barrel tumbled freely over the surface of the panel. The barrel burnishing sequence was as follows:

Barrel burnish
Rinse
Dry

*Burnishing Time*

A burnishing time of 2½ hours was observed. Since the burnishing material was out of contact with the panels for half of the time, the total rolling time was longer than usually employed for bright rolling.

*Loss of weight*—0.007 gram, corresponding to a removal of 0.000003 inch.

*Compound Used*—A commercial burnishing material was used.†

*Equipment for Plating*

In the design of the cathode-anode arrangement within the tank the recommendations of the Standard Steel Spring Company were followed with slight variations.[10] The rack was made of such dimensions that it filled the whole cross section of the tank so that current distribution comparable to the distribution in a Haring cell was approached. The panels were screwed into place, leaving spaces between the individual panels and parts of the rack of ¼ inch, while the space between the rack and the walls of the tank was about ½ inch. The anodes filled the cross section in the same arrangement as the panels. The distance between the plating rack and the anode was 6.5 inches. A special insulator made of steel, and coated with a plastisol was used to hold the rack in position and the anodes tightly in place. It was not sufficient to allow the anodes to hang down by their weight, they had to be tied down with a tape at the bottom to the insulator to secure reproducible results. The rack had a soldered extension about ten inches long. This extension was brought against a stop, and held tight against this stop with a clamp in order to insure a reproducible exact position of the rack in the tank. The cleaning, rinse and cyanide tanks were steel. The cleaner tank was fitted with glass panels along the side walls and the bottom to insure proper current distribution. The acid dip tank was neoprene lined as was the nickel tank.

The chromium plating tank was lead lined with glass panels along the sides and bottom; the arrangement of cathodes and anodes was similar to that in the nickel tank, except that in the chromium tank the distance of cathodes and anodes was reduced to 3 inches to reduce voltage requirements.

†Sprodamine S, donated by Specialty Products Company, Jersey City 2, N. J.

*Cleaning Cycle*

The panels were degreased in a two chamber trichlorethylene vapor degreaser, with one chamber for the boiling liquid, and one for the vapor phase. The degreasing cycle was adjusted to this equipment.

The loaded rack first was dipped into the boiling solvent, then held in the vapor phase until the condensation on the rack stopped (about one minute), then removed from the degreaser and allowed to cool. The panels were inspected and any dry residue was removed with a soft flannel cloth. The rack was returned to the vapor phase of the degreaser and, after condensation had stopped again, was slowly withdrawn from the vapors.

The cleaning conditions were as follows:

*Cleaning Solution*—8 oz/gal of a proprietary metal cleaner*

*Temperature of Cleaning Solution*—160° F

*Current Density in Cleaner*—20 amps/sq ft

*Cycle of Operation*—The following cycle was used:

Cathodic cleaning for one minute
Rinse in cold running water for 1 minute
Dip in 5 per cent sulfuric acid (by weight) for 30 seconds
Rinse in cold running water for 1 minute
Dip in solution of 6 oz/gal of sodium cyanide for 20 seconds
Rinse in cold running water for 1 minute
Dip in 5 per cent sulfuric acid (by weight) for 20 seconds
Rinse in cold running water for 1 minute
Nickel plate

*Loss of Weight*—0.002 gram, corresponding to a metal removal of less than 0.000001 inch

*Nickel Plating*

All panels were plated in the commercial bright nickel solution noted above: the formula is given below. As mentioned previously in this report, this particular process was chosen because it was used commercially in the plating room of the company where the project work was carried out.

The solution was controlled and maintained by analytical procedures supplemented by Hull cell tests. The nickel and other baths used in this work were maintained within ±5 per cent of normal composition. No metallic impurities were indicated by the appearance of the Hull cell test panels. The panels were plated to a thickness of 0.0005 inch with a thickness variation no greater than ±7.5 per cent. The outside ½ inch of the panel was disregarded in thickness measurements.†

The plating conditions were as follows:

| *Solution* | |
|---|---|
| Nickel sulfate | 40 oz/gal |
| Nickel chloride | 5 oz/gal |
| Boric acid | 5 oz/gal |
| Brightener No. 1RL | 0.125 per cent by volume |
| Non-Pitter No. 2 | ½ lb/100 gal |
| Brightener No. 3 | 0.8 oz/gal |
| Temperature | 120-125° F |
| *p*H | 4.5 |
| Current density | 20 amps/sq ft |

*Chromium Plating*

The chromium plating conditions were as follows:

| | |
|---|---|
| Chromic acid | 400 grams/liter |
| Sulfate Radical | 4 grams/liter |
| Temperature | 115° F |
| Current density | 125 amps/sq ft |

Time of plating: 3 minutes, corresponding to an average thickness of approximately 0.000018 inch

*Exposure of Panels*

Using the methods of surface preparation and electroplating detailed above, thirty plated brass panels of each of the following types were prepared:

| *Identification Symbols* | *Treatment* |
|---|---|
| PBC | Polished, buffed, colored and plated |
| BC | Buffed, colored and plated |
| E | Electropolished and plated |
| L | Satin finished and plated |
| BD | Bright dipped and plated |
| R | Barrel burnished and plated |

These panels were turned over to Committee B-8, ASTM for evaluation in outdoor exposure. Ten panels of each kind were exposed in each of three locations, viz:

State College, Pa. (rural atmosphere)
New York City (industrial atmosphere)
Kure Beach, near Wilmington, N. C. (marine atmosphere)

For exposure in New York City and Kure Beach, seven additional panels for each location were prepared with only the customary cleaning operation prior to plating. The deposit was applied on the surface as obtained at the rolling mill. These were marked with the identification symbol O.

## Zinc Base Die Castings

*Material*

The only zinc base die castings available for this work were 1/8 inch by 4 inch by 6 inches flat panels of ASTM alloy XXIII remaining from the earlier work of Blum and Strausser. These specimens were about 12 years old. Since the more perfect panels had been selected for the earlier work, the specimens were somewhat more defective than the average. In addition, at some time in their storage history, they had come in contact with moisture and were partially coated with a film of white corrosion products.

Since perfectly flat panels were required for the precision buffing machine and no other source of flat panels could be located, the pieces were used in spite of their unsatisfactory condition.

*Plan of Action*

It was decided to use two conditions of surface preparation: (1) buffing to a depth insufficient to penetrate the fine-grained surface skin, and (2) polishing plus buffing to a depth sufficient to remove this skin entirely. Microexamination disclosed that the fine-grained material ranged from 0.0012 inch to 0.010 inch in thickness. It was noted that there was no zone of porosity beneath the surface skin but merely a transition from the fine-grained to a coarser grained structure.

On the basis of these observations, the Committee selected the following specifications for the mechanical preparation of the panels:

*Group B*—A direct buffing to make sure that not more than 0.001 inch of metal was removed, then the coloring and plating steps

*Group C*—A polishing to remove at least 0.010 inch of metal, buffing, coloring and plating

*Polishing*

Preliminary studies indicated that polishing on the precision machine, while practicable, would be very time-consuming in view of the considerable amount of metal required to be removed. Loading of the polishing wheels was an important factor. Accordingly, the panels were cut to 4 by 4 inches and were cut down on a small belt sander using a tallow-lubricated 100-grit belt. This stage of operation was taken in a series of steps, the panels being rotated 90° between steps.

After 0.010 inch of metal had been removed, a final polishing was given on a lubricated 300-grit belt at 90° to the last previous polishing, continuing until the last traces of the 100-grit scratches had been removed. The buffing operation which followed was at 90° to the final polishing direction.

*Buffing*

At the outset, buffing was attempted with the use of a pressure of 80 pounds on the carriage. This resulted in overheating and some blistering of the surface, particularly in the group B specimens. This blistering is attributed to softening of the heated metal and expan-

*Metalex W Special donated by MacDermid, Inc., Waterbury 20, Conn., 203

†The nickel thickness was determined by microscopic sections and use of the Magne-Gage.

sion of air entrapped just below the surface. Reduction of buffing pressure to 25 pounds eliminated this difficulty, and this value was selected as standard.

The accepted buffing cycle consisted of six complete passes in each direction with the panels at 0, 180, 90, 270 and again 0° to the first direction. The buffing compound was applied to the wheel under controlled conditions after each three passes. At each application, the compound bar was advanced 0.0025 inch.

The buffing specifications follow:

*Wheel*—Packed loose buff made up of alternating small and full size section in the width ratio of 1-to-1, 11 inches in diameter, operating at 2250 rpm, giving a surface speed of 6600 feet per minute

*Carriage Motion*—24 feet per minute

*Carriage Pressure*—25 pounds

*Number of Passes*—30 per surface

*Compound*—A commercial buffing compound*

*Weight Removed*—One gram per surface corresponding to 0.00057 inch

As will be seen below in the discussion, this procedure later was altered to the extent of including a degreasing operation and a light greaseless compound cut before buffing the group B panels.

*Coloring*

The coloring specifications follow:

*Wheel*—Packed loose 11-inch buff made up of alternating small and full size sections in thickness ratio of 1-to-1. Operated at 2250 rpm, giving surface speed of 6600 feet per minute

*Carriage Motion*—24 feet per minute

*Carriage Pressure*—25 pounds

*Number of Passes*—One per surface

*Compound*—A commercial coloring compound*

*Weight Removed*—0.069 gram per surface, corresponding to 0.00004 inch

*Cleaning*

*Degreasing*—Procedure used was the same as that described for the brass panels.

*Alkaline Cleaning*—5 oz/gal trisodium phosphate solution used cathodically for 1 minute at 10 amp/sq ft and 160° F followed by a rinse in cold running water for 1 minute.

*Acid Dip*—2 per cent (by weight) sulfuric acid—immersion time 3 seconds followed by a rinse in cold running water for 1 minute and immediate copper strike.

*Copper Strike and Copper Plate*†

As stated earlier in this report, the Committee decided to use proprietary plating solutions available at the Project site in this work. The proprietary high-speed copper bath noted previously was selected for the purpose. The following plating solutions and conditions were used:

| | |
|---|---|
| *Copper Strike* | |
| Proprietary copper salt | 6 oz/gal |
| KCN | 1 oz/gal |
| Temperature | 150° F |
| Current density | 20 amps/sq ft |
| Anodes | cast copper |
| Time | 30 seconds |
| *Copper Plate* | |
| Copper (metal) | 5 oz/gal |
| Free KCN | 0.5 oz/gal |
| KOH | 4 oz/gal |
| RH-774 | 8 cc/gal |
| Temperature | 180° F |
| Current density | 20 amps/sq ft |
| Anodes | electrolytic copper sheet |
| Anode bags | Nylon |
| Time | Calculated to give required thickness |

*Copper Plating Cycle*

Parts were immersed in the copper strike with current on to establish immediate contact and then transferred to the copper plating tank without rinsing. Then followed the steps of copper plate, rinse in hot running water for 1 minute, rinse in cold running water for 1 minute, treat cathodically in electrolytic cleaner (see cleaning cycle), rinse in cold running water for 1 minute, dip for 15 seconds in 5 per cent (by weight) sulfuric acid, rinse in cold running water for 1 minute and nickel plate.

This post-plating procedure was suggested by the supplier of plating solution as a means of removing any brightener adhering to the copper.

*Nickel Plating*

The panels were plated in the proprietary bright nickel solution as noted above. Usual analytical and Hull cell tests were used for control and the solutions were held within 5 per cent of the optimum composition at all times. No metallic impurities were detected in the Hull cell tests.

Rolled depolarized anodes; twill weave cotton, desized anode bags were used.

A plating time calculated to give required thickness was observed.

*Chromium Plating*

The chromium plating solution as used for brass and described above was used for the die castings.

## Discussion

As stated earlier, the decision was reached to use the present panels in spite of their somewhat unsatisfactory condition in the hope that useful results could be obtained. No difficulties were encountered in polishing or plating the panels of group C probably because they were polished so deeply into the metal that all traces of surface defects and corrosion were removed.

Reasonably acceptable surfaces were obtained with the buffing operation in group B but considerable difficulty was encountered later when these panels were plated. Many of the deposits showed blistering immediately after plating, the blisters assuming a distinctive pattern related to that produced by etching. While the greatest density of blisters did not coincide with the greatest density of corrosion pits, a relation between these defects was indicated.

It was quite evident that some form of defect traceable to the surface corrosion previously mentioned was present which was not being removed in the buffing operation. It was not possible to increase the depth of buffing because of the specification laid down for this work. It is known that surface corrosion of zinc die castings is selective in that it attacks preferentially only part of the structure. Since overcleaning is known to produce similar effects and is a well-known cause of blistering, it is possible that the otherwise satisfactory cleaning cycle used in this work was too drastic for use with the corroded material. The ordinary small pits and minor defects in the surface not removed by the buffing seemed to plate over satisfactorily.

Since the first panels plated all showed blistering, various expedients were tried in an attempt to overcome this difficulty. The most successful of these involved a degreasing operation followed by a light greaseless buffing and polishing operation before buffing. The greaseless buffing step did not remove more than 0.0001 inch of metal. The inclusion of these steps reduced the percentage of pieces showing blisters to 25 per cent for the greaseless buffing and 30 per cent for greaseless polishing. Panels from both groups which showed no blistering were included in the set for outdoor exposure.

The failure of a large number of panels by blistering of the deposit inevitably casts doubt upon the worth of the coatings on similar panels which did not blister. For this reason, the Committee was unwilling to authorize exposure of the panels from the zinc die casting series on any but a tentative basis. The final arrangement was to expose panels from both groups B and C with the decision as to final conclusions held in abeyance pending observation of their corrosion behavior.

*Panels on Exposure*

Die cast panels were prepared by the methods detailed above. Two groups of

*Compound 2B17 and No. 3X White, respectively, donated by Hanson-Van Winkle-Munning Co., Matawan, N. J.

†All plating of zinc die castings was done with the special racks described in the section on brass. Plating solution salts were donated by E. I. du Pont de Nemours Co., Inc., Electrochemicals Department, Wilmington 98, Del.

TABLE I. ATMOSPHERIC EXPOSURE TEST OF PLATED PANELS—
0.0005 Inch Ni, 0.000010 Inch Cr. ASTM B-8, Sub II

| Code | Surface Treatment | New York—1.0 yr | | Kure Beach—0.89 yr | | State College—Approx. 1.0 yr | |
|---|---|---|---|---|---|---|---|
| | | Rating No. | Appearance | Rating No. | Appearance | Rating No. | Appearance |
| BC | Buffed and colored | (4)5, (4)2 | xpR; xeZ; xRs | (4)7, (3)5, (1)4 | ipR; sRs; iZ | 9 | spR |
| BD | Bright dipped | (10)3 | xpR; xRs | (8)6 | ipR; vsRs | 9 | iPR |
| E | Electropolished | (6)3, (4)1 | xpR; xRs; xW; xZ | (6)5, (2)3 | (6) ipR; sRs (2) xpR; xZ | 9 | ipR |
| L | Greaseless Finish | (7)3, (3)1 | xpR; xRs; xW; xZ | (8)5 | ipR; sRs | 9 | spR |
| O | Mill Finish | (7)3 | xpR; xRs | (7)6 | (6) ipR; sRs (1) ipR; sRs; iZ | | |
| PBC | Polished, buffed and colored | (5)3, (5)2 | xpR; xRs; iW | (8)6 | ipR; sRs | 10 | — |
| R | Tumbled | (8)3, (2)2 | xpR; xRs; iW | (5)6, 3(5) | (5) ipR; sRs (3) ipR; iZ | 9 | ipR |
| | | | | DIE CASTINGS | | | |
| CD | Cut 10 mils, Buffed and colored | (8)1 | xpR; xcR | (8)4 | xpR; xsB; iS; iRs | | No die castings exposed at State College |
| B | Buffed and colored | (8)1 | xpR; xcR | (8)4 | xpR; xsB; iS; iRs | | |

( ) = number of panels
See: Proceedings ASTM 1949 report of Committee B-8, Sub. II for meaning of rating numbers and symbols.

16 panels each were turned over to Committee B-8 of ASTM for an unofficial exposure test. Eight panels of each group were exposed in the industrial atmosphere of New York City and the other eight of each group in the marine atmosphere at Kure Beach, N. C.

### Atmospheric Exposure Results

The plated panels were delivered to Subsection II, of ASTM Committee B-8 during May, 1949 and were mounted on exposure racks on these dates:

New York City . . . . . June 8, 1949
Kure Beach . . . . . July 18, 1949
State College, Pa. . . . June 1949

The data on inspection results furnished to the AES Subcommittee by the ASTM was meager and somewhat confusing. However, the one rating chart furnished by ASTM is reproduced in Table I.

All of the panels from each location were collected and inspected on January 11, 1954. The panels exposed at New York City and Kure Beach had corroded to a zero rating. Those from State College were given rating numbers as follows:

| | | |
|---|---|---|
| BC | (10) | 8 |
| BD | (5) | 8, (1) 7 |
| E | (10) | 9 |
| L | (10) | 7 |
| PBC | (10) | 8.0 |
| R | (2) | 8.0 |

### Conclusions

As a result of these tests, there was no evidence that the method of surface preparation of rolled brass had any influence on the protective values of the subsequently applied electrodeposits. It was observed repeatedly by the inspectors that there were greater variations between panels of the same series than between the lots prepared by various methods.

Although the plated zinc die castings were not exposed officially because of the reasons mentioned above, the rating numbers of those cut down to remove 10 mils before being buffed and colored before plating coincided with those prepared by buffing and coloring only.

The results unquestionably were influenced by plating variables such as edge-cracking of the deposits which developed upon exposure. Again, the results would have been of greater value had it been possible to prepare and expose a greater number of panels.

This research, although unsatisfactory in many of its aspects, has indicated that the method of surface finishing of the rolled brass and zinc die castings selected for this Project has no pronounced effects on the protective value of electrodeposits. In the preparation of the samples it must be remembered that all panels were brought to a commercially smooth surface before plating. The effect of plating on surfaces with coarser final finishes as it might be related to protective values has not been investigated.

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# FOURTH INTERNATIONAL CONFERENCE— A HIGHLY SUCCESSFUL MEETING

BY WALTER R. MEYER*

On April 21 to the 24, the Fourth International Conference on Electrodeposition and Metal Finishing was held in London. This Conference was sponsored by the Institute of Metal Finishing (Great Britain), the American Electroplaters' Society, and the Commission Belge de L'Electrodeposition. The representatives of the American Electroplaters' Society on the International Council for Electrodeposition that planned and conducted the session were Walter L. Pinner of Houdaille-Hershey Corporation, Detroit, Mich.; and the author of this report.

The conference was truly international in nature. Over 500 delegates excluding ladies and guests were present from over 14 countries. The number of delegates from countries outside of Great Britain were as follows: Austria (1), Belgium (7), Finland (1), France (17), Germany (13), Holland (14), Italy (3) Yugoslavia (1), Norway (1), Sweden (9), Switzerland (14), United States of America (20). Those present from the United States were: Dr. William Blum, retired from the National Bureau of Standards, Washington, D. C.; J. F. Carland, Chandeysson Electric Co., St. Louis, Mo.; T. G. Coyle, United Chromium, Inc., New York, N. Y.; Myron Diggin, Hanson-Van Winkle-Munning Co., Matawan, N. J.; Dr. C. L. Faust, Battelle Memorial Institute, Columbus, Ohio; R. T. Gore, King's Highway, Middletown, N. J.; R. O. Hull, R. O. Hull & Company, Rocky River, Ohio; G. W. Jernstedt, Westinghouse Electric Corporation, E. Pittsburgh, Pa.; Dr. L. Lancy, Country Club Drive, Ellwood City, Pa.; Dr. F. Lowenheim, Metal & Thermit Corporation, Rahway, N. J.; M. M. Messing, Bart-Messing Corporation, Belleville, N. J.; Dr. Walter R. Meyer, Enthone, Inc., New Haven, Conn.; R. J. O'Connor, Contract Plating Company, Inc., Stratford, Conn.; J. T. O'Reilly, Ford Motor Company, Dearborn, Mich.; E. C. Rinker, Sel-Rex Precious Metals, Belleville, N. J.; Dr. R. B. Saltonstall, Udylite Corporation, Detroit, Mich.; Dr. Ralph Schaefer, Clevite-Brush Development Corp., Cleveland, Ohio; Miss H. E. Schneider, Standard Plating Rack Company, Chicago, Ill.; Dr. W. Wesley, The International Nickel Company, Bayonne, N. J., and Mrs. J. Wiarda, 381 Broadway, Westwood, N. J.

There were several other members from the United States that attended some of the meetings but did not register at the conference. A large portion of the credit for the success of the conference should go to the members on the Council representing the Institute of Metal Finishing. Although the time involved in the planning of the meeting was short and the delays of communication with foreign countries were many and unavoidable, the entire program ran with great smoothness. Some of the men who worked so earnestly for the success of the meeting were Dr. J. W. Cuthbertson, President of the Institute of Metal Finishing; Dr. Sidney Wernick, Secretary of the Institute of Metal Finishing; Dr. T. P. Hoar, Dr. R. A. Hammond, and Messrs. E. A. Ollard, H. Silman and F. J. James.

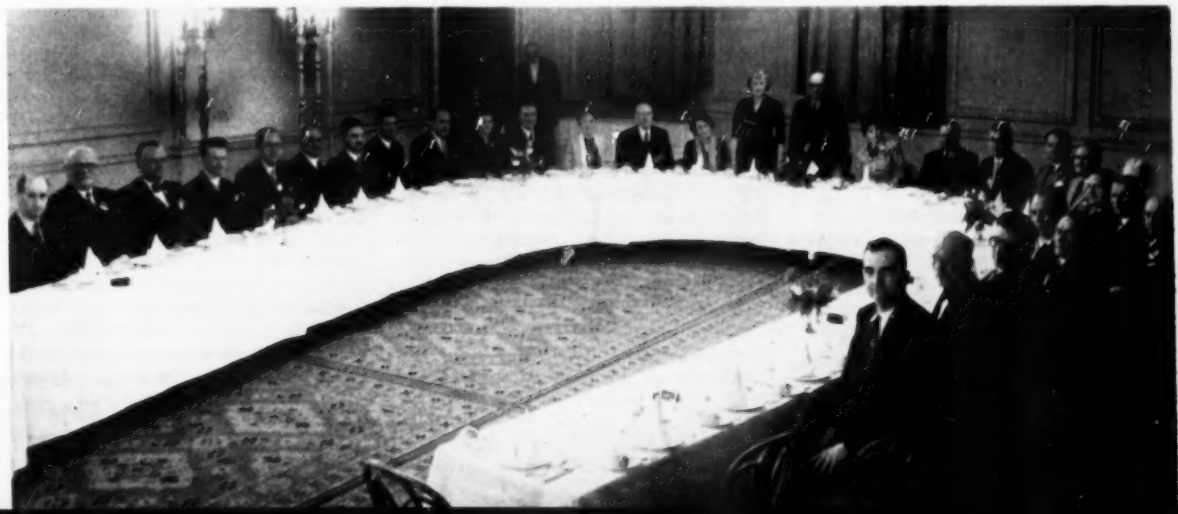
The Council is a standing body that plans international conferences, and the next international conference would logically come about 1959. It was hoped by the committee that it could be held in the midwest portion of the United States of America.

### Social Events Very Successful

It was agreed by all with whom the writer spoke that the social aspects of the meeting were the greatest of any meeting that the American members had attended both in the United States and in foreign countries. First of all, members of various nations had a chance to get together for the first time to see what each other looked like and to discuss problems in detail. This aspect alone made the trip to Europe worthwhile. However, the planned functions conducted with both English ceremony and humor made them highly entertaining to the foreign guests. Luncheon meetings were held each day at the Conference Hall of an informal nature. The most enjoyable meeting, however, was the Annual Banquet held at a famous guild hall, The Fishmongers' Hall, under the chairmanship of the Institute's president, Dr. J. W. Cuthbertson. The banquet was of a formal nature with introduction of each guest by a footman as they arrived and with formal seating. After the loyal toast had been given with the appropriate wine, various toasts were presented by dignitaries of the Conference. Dr. Ralph Schaefer (First Vice-President, American Electroplaters' Society) proposed a toast

*President, Enthone, Inc., New Haven, Conn.

*Photo taken at the complimentary dinner given to Dr. William Blum by the Council of the Institute of Metal Finishing*



to "The Institute of Metal Finishing." Dr. T. P. Hour presented an interesting toast to "The Metal Finishing Industry." Other toasts and remarks were made by Major L. H. Peter, Dr. R. Hammond and Sir Frederick Handley-Page of aircraft manufacturing fame. The dinner was beautifully served and was very appetizing. Dancing was reserved for the Dinner-Dance held later.

The other social event which proved to be very successful and enjoyable was the final dinner and dance which was somewhat like those held by the American Electroplaters' Society except with somewhat greater formality.

### Interesting Technical Papers and Discussions Presented

The technical sessions were outstanding in diversity of subject matter covered, text, and by the number of prominent scientists present to present the papers and to discuss them. Summaries of papers were presented by the author or a selected representative. Following this one or more selected individuals presented short criticisms or discussions of the paper on a formal basis. They were then open for discussion by any of the members present. Perhaps the only criticism that could be made of the technical session was the crowding of so many papers in such short periods of time that necessitated limiting presentation time and discussion. The technical papers that were presented will be mentioned only briefly at this time. All of the papers together with complete discussion will be available to the members of the American Electroplaters' Society in a bound volume at a presubscription rate of five dollars on all orders received by the Secretary of the American Electroplaters' Society by September 1, 1954. To nonmembers of the American Electroplaters' Society and orders received from members of the American Electroplaters' Society after September 1, 1954, the price will be approximately nine dollars.

### Summary of Technical Papers

Three papers were presented dealing with aluminum. In the paper, "The Scientific Basis of Anodic Oxidation Treatments of Aluminum and Its Alloys" by P. Lacombe, Ecole Superieure des Mines, Paris, France, the electrolytic and structural factors influencing the growth and properties of the alumina film produced by anodic treatment of aluminum and aluminum-rich alloys were reviewed, with special reference to French work during the last decade.

Electrolytic and chemical polishing pretreatments used with subsequent anodic oxidation to give "bright" anodic finishes were discussed similarly.

Another paper, "Industrial Methods of the Brightening and the Anodic Oxidation of Aluminum and Its Alloys," was submitted by J. F. G. Herenguel, Centre de Recherches d'Antony, Antony (Seine), France. Here the recent development in France of anodic oxidation processes for aluminum and its alloys was described. Four main classes of treatment are in use, respectively designed to give protection from corrosion, and "industrial," "decorative" and "bright" finishes. Types of alloys suitable for the processes were given, and the precautions necessary for the avoidance of the several kinds of defects. Electrolytic and chemical brightening processes suitable for use in conjunction with anodic oxidation also were discussed. Improvements and developments not yet fully exploited were noted.

An abstract of the paper, "Phosphoric Acid Anodizing of Aluminum and Its Application to Electroplating," by R. C. Spooner and D. P. Seraphim, Aluminum Laboratories, Ltd., Kingston, Ontario, Canada, will be published in the Article Abstracts section of this journal. Also to be abstracted similarly are the following papers: "The Electrodeposition of Gold and Other Alloys by a New Method," by G. E. Gardam, Aluminum Laboratories, Ltd., Banbury, Oxon, and N. E. Tidswell; "Progress in Tin-Nickel Electroplating," by A. E. Davies, Tin Research Institute, Greenford, Middlesex; "Tin-Alloy Plating: American Experience," by Frederick A. Lowenheim, Metal & Thermit Corporation, Rahway, N. J., U. S. A.; "A Quantitative Adhesion Test for Electrodeposited Chromium," by C. Williams and R. A. F. Hammond, Armament Research Establishment, Fort Halstead, Sevenoaks, Kent; "The Diffusion of Chromium and Other Elements Into Nonferrous Metals," by R. L. Samuel and N. A. Lockington, Diffusion Alloys, Ltd., New Eltham, London, S. E. 9, England; "The Influence of Annealing on the Structure and Hardness of Electrodeposited Chromium," by C. P. Brittain and G. C. Smith, University of Cambridge, Dept. of Metallurgy, Cambridge, England; "Nickel Plating from the Sulfamate Solution," by Myron Diggin, Hanson-Van Winkle-Munning Company, Matawan, N. J.; "Bright Nickel Plating —A Review of Progress," by R. B. Saltonstall, The Udylite Corporation, Detroit, Mich.; "The Prevention of Cracking in Nickel Electrodeposits," by T. E. Such, Wilmot-Breeden, Ltd., Birmingham, England; "Studies of the Action of Organic Compounds at the Surface During the Electrodeposition of Nickel," by Henry Leidheiser, Jr., Virginia Institute for Scientific Research, Richmond, Va.; "Corrosion or Protection at Gaps in Metallic Coatings on Steel," by U. R. Evans, Department of Metallurgy, University of Cambridge; "The Resistance of Some Cast and Plated Sleeve-Bearing Materials to Cavitation Erosion," by R. A. Schaefer, J. R. Cerness and H. A. Thomas, Clevite-Brush Development Co., Cleveland, Ohio; "The Weathering of Nickel/Chromium Electrodeposits," by W. A. Wesley and B. B. Knapp, Research Laboratory, International Nickel Company, Inc., Bayonne, N. J.; "A New Type of Primer for Resistance Welding," by A. J. Elleman and N. D. P. Smith, Imperial Chemical Industries Ltd., Paints Division, Slough, Bucks; "Automotive Organic Finishing," by James O'Reilly, Ford Motor Company, Dearborn, Mich.; "Glass-Fibre Reinforced Plastics: A New Material of Construction for the Finishing Industry," by H. Silman, Ford Research Centre, Birmingham, England; "Notes on Cleaning Cycles for Plating," by A. Kenneth Graham, Graham, Crowley & Associates, Inc., Jenkintown, Pa.; "On the Experimental Methods for the Determination of Electrode Polarization," by R. Piontelli, Laboratorio di Elettrochimica, Chimica-Fisica e Metallurgia del Politecnico di Milano, Milano, Italy; "The Electrodeposition of Porous Metal," by Charles L. Faust and William Safranek, Battelle Memorial Institute, Columbus, Ohio; "Unsolved Problems in the Metal Finishing Industry," by Walter L. Pinner, Houdaille-Hershey Corporation, Detroit, Mich.; "Universal Metal Finishing Problems—A Plea for International Cooperation," by Sidney Wernick, Consultant, Alexandra Grove, 17, London, N. 12, England; "Radiotracer Study of Electrochemical Displacement on Metals," by M. Simnad and Ling Yang, Metals Research Laboratory, Carnegie Institute of Technology, Pittsburgh, Pa.; and "Morphology of the Growth of Isolated Crystals in Cathodic Metal Deposits," by Hellmuth Fischer and Dr. Habil, Technische Hochschule, Institut für Physikalische Chemie & Elektrochemie, Karlsruhe, West Germany; and Heinz Felix Heiling, Technische, Universität, Institut für Metallhüttenkunde, Berlin-Charlottenburg, Germany.

### Corrosion and Electrolytic Polishing

Papers under this subject received a great deal of attention. The papers by Mondon and Zentler-Gordon on "Electrolytic Polishing and Metal Fatigue" raised a great deal of comment because of the great interest in this subject for the aircraft industry. The recent crash of another Comet Jet airliner focused attention on all subjects that might lead to lowered structural strength or fatigue resistance of metals and alloys. The articles as well as the discussions should prove to be of great value to many of the members of the American Electroplaters' Society.

The summary of the paper, "Electrolytic Polishing and Metal Fatigue," by R. Mondon, Societe Jacquet-Hispano-Suiza, Paris, France, and H. E. Zentler-Gordon, Modern Electrolytic Processes & Patents Ltd., London, England, follows: The reductions in fatigue resistance encountered after electropolishing and electromachining were explained by the complete removal of the compression lay-

ers caused by previous finishing operations (machining, grinding, honing, polishing). Whenever necessary, this enhanced fatigue resistance, which is not an intrinsic property of the metal, can be restored fully by a final treatment of the vapor-honing type. Electromachining (and to a certain extent electropolishing) exposes the true fatigue resistance of a metal and provides a useful production tool for removing metal uniformly from intricately shaped parts without introducing unknown stresses into the surface. By specifying alloys suitable for electromachining, metallurgists can avail themselves of two additional advantages: a considerable saving in production costs and a very sensitive method of inspection for highly stressed parts. In the authors' view, it is easier to design for electromachining and electropolishing than to design for electroplating.

*Miscellaneous Papers*

A miscellaneous group of papers was presented on both theoretical and practical subjects. Among these papers were: "Recent Advances in Tinplate Manufacturing Processes," by W. E. Hoare, Tin Research Institute, Greenford, Middlesex.

Developments in the manufacture of tinplate were described, with particular reference to continuous-strip cold-reduced steel base, continuous electrolytic tinning and improvements in the hot-tinning method.

"Electroplating with Modulated Current" was presented by P. Baeyens, N. V. Philips' Gloeilampenfabrieken, Eindhoven, Holland.

The adjective "modulated" is proposed for any current that undergoes some changes of value, either absolute or of sign, which change is repeated periodically and whereby a great number of cycles is used in one electroplating operation.

The different forms of modulated current and ways of producing them were described, and the importance of the parameters of such current was discussed.

A review was given of the literature of the use of modulated current in electroplating, with the exclusion of anodic oxidation and the formation of conversion coatings.

SESSION OF AMERICAN ELECTROPLATING PRACTICE

Dr. Sidney Wernick was chairman of a session at which representatives of the American Electroplaters' Society presented summaries on various subjects in electroplating, and the meeting was then opened for general discussion. This proved to be a highly interesting session with much comment, and again the only criticism was the shortness of time. The following members of the American Electroplaters' Society took part in the discussion: Dr. Walter R. Meyer, Enthone, Inc., New Haven, Conn., on "Cleaning and Preparation of Metals for Electroplating"; Dr. Charles L. Faust, Battelle Memorial Institute, Columbus, Ohio, on "Bright Dipping and Electropolishing"; Dr. R. B. Saltonstall, Udylite Corporation, Detroit, Mich., on "Bright Plating"; T. G. Coyle, United Chromium, Inc., New York, N. Y., substituting for Walter L. Pinner, on "Practical Aspects of Plating"; and Myron Diggin of Hanson-Van Winkle-Munning Company, who contributed greatly to the meeting by his discussions on various phases of plating as well as a presentation of pictures illustrating typical American electroplating equipment.

*Dr. William Blum receiving the Hothersall Memorial Medal from the president of the Institute of Metal Finishing, Dr. J. W. Cuthbertson*

*Pinner Unable To Attend*

It was with extreme regret that the members of the Conference learned that illness prevented Walter L. Pinner from attending. He is well known throughout England and Europe as well as, of course, the United States of America and many friends expressed their desire to have their best wishes sent to him.

*Dr. William Blum was Hothersall Memorial Lecturer*

At the meeting of the Institute of Metal Finishing held on Tuesday afternoon preceding the International Conference, Dr. William Blum, who is known so well to the AES, gave a very interesting and creditable talk as the Hothersall Memorial lecture in honor of the late Arthur W. Hothersall. The subject of Dr. Blum's talk was, "The Future of Electroplating," which summarized the present condition of the art but made no predictions of sensational new developments. The talk was extremely well received and made the members attending the Conference from the United States of America very proud. Following the Conference, Dr. Blum gave a series of talks which were again well received at the various branches of the Institute of Metal Finishing.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*The Integrated Waste Treatment System for Metal Finishing Wastes*

LA SALCO, INC. (c)
2818–2838 La Salle St., St. Louis 4, Mo.—Any Branch
Name of speaker depends upon the time of the meeting
Subject:
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DR. H. L. KELLNER, Technical Director—East and Midwest

Subject:
*Bright Copper Plating*

ELLSWORTH T. CANDEE, Director of Development and Research—East
Subject:
*Newer Techniques in Buffing*

LEA-RONAL, INC. (c)
42–48 27th St., Long Island City, New York, N. Y.—East and Midwest
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FRED I. NOBEL, Secretary
Subjects:
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*Bright High Speed Silver Plating*
*Bright Gold Plating*
*Bright Acid Copper Plating*
*Leveling in Acid and Cyanide Copper Baths*

MAAS & WALSTEIN COMPANY (c)
2121 McCarter Highway, Newark 4, N. J.—Any Branch
B. F. AMES, Sales Manager
Subject:
*New Developments in the Field of Organic Coating*

MAC DERMID, INC. (c)
Waterbury 20, Conn.—Geographical limits to be determined
WILLIAM P. INNES, Technical Director
Subject:
Topics related to electroplating

METAL & THERMIT CORP. (c)
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DR. FREDERICK A. LOWENHEIM, Supervisor Electrochemical Research
Subject:
*New Developments in Tin and Tin Alloy Plating*
ROBERT T. GORE, Technical Service Engineer
Subject:
*Practical Aspects of Tin and Tin Alloy Plating*
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J. C. MILLER CO. (c)
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J. A. BADALUCO, Vice-President and Director of Research
P. A. WAALKES, Research Chemist
WILLIAM T. HAKKEN, Jr., Research Chemist
Subject:
*Tripoli as an Abrasive in the Development and Manufacture of Buffing Compositions*
Slides or movies or both are available on the subject of tripoli
W. L. MORGAN, Plant Manager and Finishing Engineer
Subject:
*Practical Application of Buffing and Polishing*

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*Methods of Buffing and Polishing*
*Standard and Special Equipment for Metal Finishing*

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GEORGE E. BEST, Manager of Technical Service
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*Interesting Applications of Chromium Plating*
*Metal Finishing's Use of Chromium Chemicals*

NORTON COMPANY (c)
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MALCOLM M. MAYNES, Abrasive Sales Engineer
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*Precision Barrel Finishing*
*Abrasive Polishing*

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ARTHUR W. LOGOZZO
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1. Color Movie on *Hard Chromium*
2. Color Movie on *Bright Nickel and Chromium*

OAKITE PRODUCTS, INC. (c)
19 Rector St., New York 6, N. Y.—Any Branch
DR. DONALD PRICE, Technical Director
GERALD A. LUX, Technical Education Director
MARTIN F. MAHER, Sales Department
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J. W. CARROLL
Subject:
*Acid Treatment Prior to Electroplating*
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FRANK HANEY, Chief Rectifier Engineer
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(Electrical Equipment):
A. P. COLAIACO, Supervising Engineer Rectifier Section, Transportation and Generator Division
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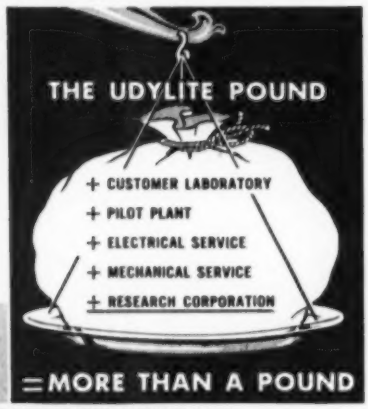


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# *Book Review*


DR. HAROLD J. READ
*Professor of Metallurgy, The Pennsylvania State University*


PROCEDURES IN EXPERIMENTAL METALLURGY by A. U. Seybolt and J. E. Burke, 1953, xi + 340 pages. John Wiley and Sons, Inc., 440 Fourth Avenue, New York 16, N. Y. Price, $7.00.

Although many metallurgical texts and reference books contain extensive descriptions of the working of metals under industrial conditions, very little has been available hitherto in the way of a comprehensive and detailed treatment of means of carrying out metallurgical operations in the laboratory. The steadily increasing attention which is being directed to fundamental research in metallurgy emphasizes the need for a book of the sort which Seybolt and Burke have produced.

The authors have tried to deal with the operations of preparing a metallic sample up to the point of making observations of metallic properties. Selection or preparation of the base metal, alloying, melting without loss of purity or change in alloy composition, casting, fabrication to desired physical form and heat-treatment to obtain a desired structure are all covered in appropriate detail. Although these operations are the ones traditionally used in metal preparation, other and more specialized techniques also are described, e.g., powder metallurgy and preparation of metallic single crystals.

A book on laboratory procedures is all too often nothing but a collection of "cook book" directions. Seybolt and Burke have transcended this limited approach and have integrated into their descriptions a good deal of background material which will enable the intelligent experimenter to go beyond the specific details given in the book in his attacks on new and highly specialized problems. The chapter in which the manufacture and use of crucibles is described is an excellent example of this approach. It opens with a discussion of the principles of selection of material and then translates these principles into practice. Striking a proper balance between background material, design details and manual operations require much skill and care in the writing of a book on laboratory methods. The authors have succeeded admirably in this respect.

There may be those who will object to the space devoted to temperature measurement and control, arguing that these subjects are treated extensively in many texts. Probably a greater number of readers will appreciate the completeness which these chapters lend to the book.

Many readers will find the long table of specifications for pure metals very helpful, and the information as to sources of pure metals is worth several times the cost of the book. In all, the book will be very useful to anyone working experimentally with metals.

Plant Engineer Byron Hill is shown at part of tank and ducting system constructed for Cannon Electric Company, Los Angeles, Calif., by Horace Blackman Co., Culver City, Calif. Acids ate through every metal tried, but have not affected Boltaron 6200.

Cannon Electric Company, manufacturers of Cannon plugs (electric cable connectors), has one of the largest, best-equipped plating shops in Los Angeles. For years they have been faced with high maintenance and replacement costs on tanks and duct systems. A corrosive solution of equal parts nitric acid, sulfuric acid and fluoride salts ate through every available metal in two to six months.

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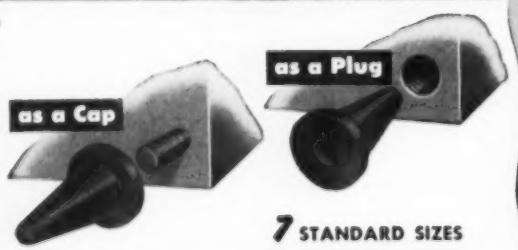


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# Article Abstracts

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**Experiments Concerning the Infrared Goniometric Reflectance Characteristics of Metallic Surfaces.*** John T. Agnew, Richmond B. McQuistan, and Leon L. Deer.

Measurements have been made of infrared goniometric reflectance characteristics of various metallic surfaces. Samples consisted of solid metallic surfaces, which have been treated in various ways to vary surface roughness, metallic powders, and filings, which have been screened to various sizes. Various thicknesses of different material were electroplated anodized, and evaporated onto the surfaces. Correlation has been made between surface conditions and the goniometric characteristics of the target. A description is given of the apparatus and techniques used to obtain these measurements. A globar, operated at 1330° K, was used as an infrared source. Goniometric reflectance characteristics of the sampler in various regions of the infrared spectrum were studied by means of quartz and calcium fluoride filters. The relationship of these measurements to the reflection from a perfectly diffuse infrared standard is discussed.

**"Stabilized Breakdown" Phenomenon in Selenium Rectifiers.*** A. C. English, P. J. Colleran, A. Just, and W. H. Tobin.

Under certain conditions of temperature and electrical loading it is possible to observe a condition of "stabilized breakdown" in selenium rectifiers where, after passing through a phase of instability and rapid deterioration, a stabilizing mechanism appears which makes the cell quite insensitive to increasing power input or rising ambient temperature. This phenome-


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non is discussed and an interpretation suggested on the basis of a localized melting such as might occur at grain boundaries. A remarkably rapid grain growth is observed.

**Titanium Dioxide Rectifiers: Production Methods and Electrical Properties.*** T. S. Shilliday and C. S. Peet.

A study was made of several methods for enhancing rectifying characteristics of semiconducting titanium dioxide formed by thermal oxidation of titanium metal. Methods investigated include thermal diffusion of impurities into $TiO_2$ films, use of a special preoxidation cleaning step for titanium, and formation of artificial barrier layers on $TiO_2$ films, and anodization of $TiO_2$ films. The effectiveness of these methods was evaluated on the basis of resultant changes in rectifier characteristics and on the reproducibility of those characteristics.

**Deposition of Titanium Coatings From Pyrosols.*** A. W. Schlechten, M. E. Straumanis, and C. B. Gill.

It has been found that the titanium dispersed in fused salts can be deposited upon other metals, especially on copper and iron. For example, if a piece of copper sheet is placed in close proximity to a titanium sheet (but not in actual contact) and then the whole is immersed into a fused salt, preferably NaCl or KCl, titanium will be transferred to the copper sheet. The thickness of the titanium layer on the copper increased with temperature and with time, approaching a maximum thickness of 0.001 to 0.007 inch. Titanium forms a coherent layer on the metals mentioned and protects them from corrosion. The substrate can be dissolved from the reverse side (Fe in $FeCl_3$, Cu in $HNO_3$), and the titanium coating remains.

The mechanism of titanium transfer is thought to consist of titanium pyrosol formation and the deposition of the titanium particles upon other metals with the formation of alloys. A similar behavior has been observed with other metals.

*Presented at Electrochemical Society meeting at Chicago, May, 1954.


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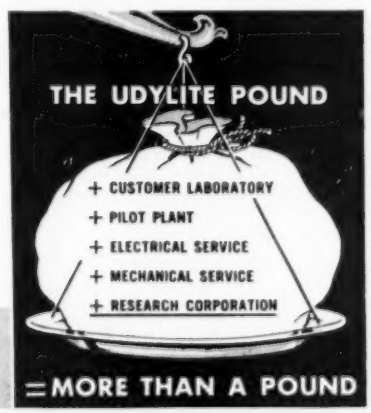


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# *Patent Abstracts*

**DR. D. GARDNER FOULKE**

Manager, Electrochemical Development
Hanson-Van Winkle-Munning Co.
Matawan, New Jersey

**Copies of patents may be obtained by writing to Commissioner of Patents, Washington, D. C. Price 25 cents each.**

*No. 2,665,223, January 5, 1954—A Process for Depositing an Aluminum Film on a Substrate by Thermal Vaporization—Philip J. Clough and Earl E. Chadsey, assignors to National Research Corp., Cambridge, Mass.*

A process for the deposition of aluminum by thermal evaporation of molten aluminum in a vacuum. The aluminum is placed on a carbon support carrying a layer of metal (titanium, hafnium, vanadium, columbium, tantalum) carbide to protect the carbon support from undue attack. 11 claims.

The field of metal evaporation is of limited interest to metal finishers, but on January 5 the activity was great, the following patents being issued: 2,665,224 (Clough and Godley); 2,665,225 (Godley); 2,665,226 (Godley and Clough); 2,665,227 (Clough and Godley); 2,665,228 (Stauffer); 2,665,229 (Schuler and Mansir); 2,665,320 (Chadsey and Clough); 2,664,852 (Chadsey); 2,664,853 (Schuler)—all assigned to National Research Corp.

*No. 2,665,231, January 5, 1954—Coating Process with Alkali Metal Phosphates and Added Fluoride Salt, Paul Leslie Amundsen and Walter A. Osip, assignors to Parker Rust Proof Co., Detroit, Mich.*

A method for coating iron, steel, zinc and zinc alloys by subjecting the metal to the action of an aqueous solution which consists of an alkali metal phosphate and an activator consisting of an alkali fluoride and acid fluoride, the relative concentration of each being such

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as to maintain a *p*H of 3.0–5.8. The phosphate concentration is between 15 and 95 per cent of the total chemicals in solution.

*No. 2,665,232, January 5, 1954—Method and Solution for Treating Zinc Surfaces to Inhibit Formation of White Rust—Richard A. Neish, assignor to United States Steel Corp.*

This method for retarding the formation of zinc corrosion products includes treating the zinc surface with an aqueous solution of an alkali metal salt of chromic acid (0.1–1 per cent) and sodium silicate (40 ml 40° Bé/l), and drying to form a microscopic film on the zinc.

5 claims.

*No. 2,665,243, January 5, 1954—Method of Providing Aluminum with a Flexible Oxide Coating—Gerald W. Young and John L. Hain, assignors to General Electric Co., Schenectady, N. Y.*

This method of providing aluminum surfaces with a flexible insulating oxide consists of anodizing in a dilute oxalic acid solution, 2.5–10 per cent by weight oxalic acid at 80°–95° C using 240 asf for about 75 seconds, then immersing in an aqueous flexing bath for ½ to 2 minutes. The latter solution consists of 2.5–10 per cent oxalic acid held at 84°–94° C.

5 claims.

*No. 2,665,247, January 5, 1954—Apparatus for Electropolishing Metals—John F. Jumer, Chicago, Ill.*

An apparatus designed to permit the electropolishing of the interior surface of metal containers consists of a reservoir over which the objects to be electropolished are placed on a suitable anode, a support on an axis parallel to the anode and carrying pipes through which the electropolishing solution may be pumped and to which the cathodes are attached. Holes are drilled in the pipes near the suspended cathode to provide electrolyte to all the containers being electropolished at substantially the same rate.

3 claims, 5 figures.

*No. 2,666,023, January 12, 1954—Anodic Coating of Aluminum—Otto Schaaber by mesne assignments to Siegfried Junghans, Schorndorf, Germany.*


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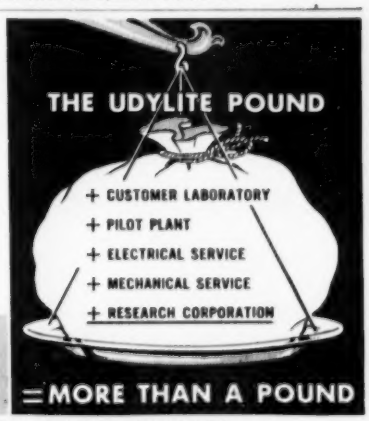


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*PATENTS PENDING

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The production of corrosion resistant, substantially poreless oxide coatings is claimed wherein an aluminum base metal is anodized with direct current in a water-free fused salt bath consisting of at least one alkali metal nitrate and one alkali metal nitrite. The anodizing current is supplied intermittently for periods of 1–10 seconds with the periods of current interruption being at least as long as the time current is supplied, the voltage being up to 50 volts. The voltage may vary between –2.0 and 0 volt to a positive anodizing voltage of 50. Broad bath claims of temperatures are made with 350°–550° C being specifically mentioned as is the addition of an iron compound, a copper compound, an alkali metal chromate (1–50 per cent) and citric acid (0.1–2.5 per cent).

10 claims.

*No. 2,666,029, January 12, 1954—Electrode for Chromium Plating—Lacey Glenn De Quasie and Robert Kochs, assignors to Rochester Lead Works, Inc., Rochester, N. Y.*

This invention describes a lead electrode for chromium plating consisting of lead or lead alloys with the hook portion being continuous. The underside of the hook is grooved and in this groove is placed a copper element (bar or rod) to strengthen and provide conductivity. The copper conducting portion of the hook extends from the end to a point slightly above the plating solution and is laid in a solder lining. The portion of the copper below the lower point of contact with the anode rode is covered with solder.

5 claims, 5 figures.

*No. 2,666,738A, Bright Silver Plating, January 19, 1954—Otto Kardos, assignor to Hanson-Van Winkle-Munning Co., Matawan, N. J.*

A process for producing bright silver electrodeposits from aqueous silver cyanide solutions by the addition of 0.02–0.04 oz/gal of the water and acid insoluble, but alkali soluble, reaction product of a ketone of the formula $RCH_2COCH_3$ with carbon disulfide in the presence of an alkali hydroxide. R is described as hydrogen, alkyl, acetonyl and alkali metal carboxymethyl ($CH_2COO$ Na or $CH_2COOK$). A further claim


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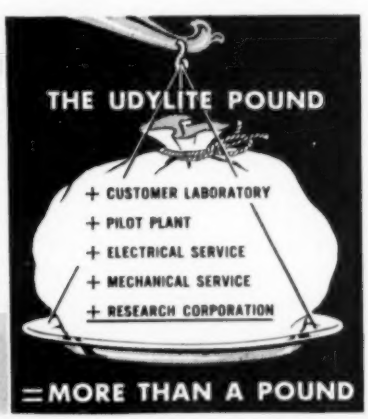

covers the use of Turkey-red oil in combination with the alkali soluble resin. Example 1 describes the reaction product as formed from 0.2 mol acetonyl acetone, 0.8 mol carbon disulfide with 1.2 mols of aqueous sodium hydroxide.

10 claims.

*No. 2,667,453, January 26, 1954—Method of Electroplating Copper on Metal Articles—Guy E. Murry, assignor to Western Electric Company, Inc., New York, N. Y.*

This method applies to the plating of fine wires which are advanced as a cathode through a copper cyanide strike solution (copper 1.5–3.0 oz/gal) at 20 to 75 asf to provide a fine-grained deposit and set a grain size pattern, through a second cyanide copper bath (copper 4.5–7 oz/gal) at a higher current density to yield a continued fine-grained deposit, and finally through an acid copper bath at still higher current densities to increase materially the electrical conductivity of the resulting composite wire.

11 claims.

*No. 2,667,455, January 26, 1954—Method for Electrolytic Production of Iron from Iron Sulfate Solutions—Sigurd Aannerud and Eigil Mostad, assignors, by mesne assignments, to Pryor, Ltd., Pembroke, Bermuda.*

This method of recovering iron from aqueous solutions of iron sulfate includes the use of a vinyl chloride—acrylonitrile fabric diaphragm, stabilized at 150° C with a shrinkage of 12–16 per cent. This fabric is claimed to be resistant to chemical attack and not to increase the cell voltage seriously.

2 claims.

*No. 2,677,433, January 26, 1954—Process for the Diffusion-Substitution Coating of Metal Articles from a Tin Salt Melt—Erich Gebhardt and Gehard Schrag, assignors to Meinecks, Metallurgie G.m.b.H., Hannover, Germany.*

A method for the tin coating of iron articles by immersing in a molten bath consisting of at least 60 per cent $KCl.SnCl_2$, the rest being composed of a substance selected from the group—alkali metal, alkaline earth metal and zinc halides. Temperature of operation is 300°–500° C.

9 claims.

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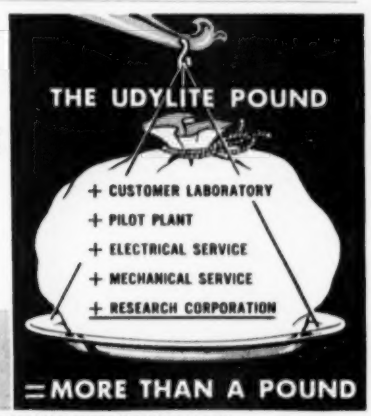


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# AES News

### PLATING Names New Editor

Morrison

Korbelak

Lee H. Morrison of New York has been named Editor of PLATING by the AES Executive Board. He was one of more than fifty applicants screened for the position that was vacated by Al Korbelak on June 18. Morrison's appointment was effective as of June 14.

Morrison comes to PLATING with more than twenty years of editorial experience, much of it in technical editing in the fields of chemical, electrical and mechanical engineering and in metallurgy. He has engaged in newspaper, magazine and book publishing, as well as public relations and publicity.

Prior to joining the staff of PLATING, he was Director and Editor in Chief of Avery Press, a New York firm that specialized in publishing scholarly reference books. He also served as Editor at International Correspondence Schools, Scranton, Pa.; Editor at the Columbia University Press, New York; Editor of Public Utilities Fortnightly, Washington, D. C.; Editor of Mexican Commerce and Industry, Mexico City; and Editor of the Monterrey Times, Monterrey, Mexico.

Morrison is a graduate of Columbia University, New York.

Al Korbelak joined Sel-Rex Precious Metals, Inc., as Sales Manager on June 7, but he continued to work part time until June 18 in getting out the July issue.

### Temporary Branch Charters

Continued growth in the number of new Society branches is noted in the granting of temporary charters to 3 new branches. The branches are: Capitol District, representing the Albany, Schenectady, Troy, N. Y., area; San Antonio, Texas; and Southern Tier, representing the Binghamton, Elmira, Endicott, N. Y., area.

### Error Convention Committee List

In the past issue Milton Nadel was listed erroneously as working on entertainment for the New York Convention in place of his actual assignment as educational chairman. This error is regretted. Nadel also is a district captain for the AES Research Finance Subcommittee, assigned to the New York City and Newark branch areas.

### AES Officer Candidate Withdraws

Letters have been sent to the various branches announcing the withdrawal of Leslie Diveley as a candidate for the office of third vice-president of the Society.

Diveley

This action follows upon the advice of the candidate's physician to avoid any increased responsibility at this time.

### 1953-1954 Membership Campaign Winners—Revised Status

Final reports from the various branches that affected the standings of the membership competition have been received at Headquarters. The official and corrected standings now show that the Detroit, Syracuse and Western Ontario Branches won the top honors in their respective divisions. Formal awards in recognition of this record will be granted of the above branches at the final business meeting of the Society at the New York Convention.

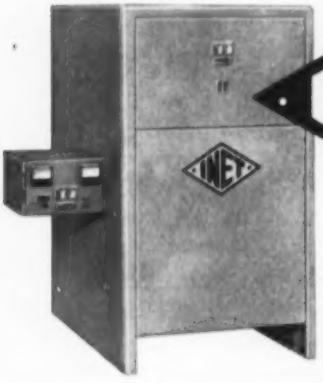
### Cleveland AES Auxiliary Formed

Thirty women, wives of the members of the Cleveland Branch of the American Electroplaters' Society, met in the English Room of the Hotel Carter January 20th to form an auxiliary. Mrs. Frances Hoffman, as temporary chairman, presided at the meeting in February at which time the bylaws were read and the purpose of the auxiliary was discussed. At the third meeting, March 9, at the Hotel Cleveland, the constitution was read and accepted and the following officers were elected: President, Mrs. A. R. Hoffman; Vice-President, Mrs. George Shepard; Recording Secretary, Mrs. William King; Corresponding Secretary, Mrs. Theodore Pavlish; and Treasurer, Mrs. Robert Platt.

The auxiliary has assumed, as its first big project, the responsibility of planning and organizing the ladies' activities for the 1955 convention in Cleveand.

**First Branch Contributor to Research Fund, 1954-1955**
**Toronto Branch, AES. $151.00**

The above branch has remitted this amount in addition to its per capita tax and is commended for doing something extra for the AES.

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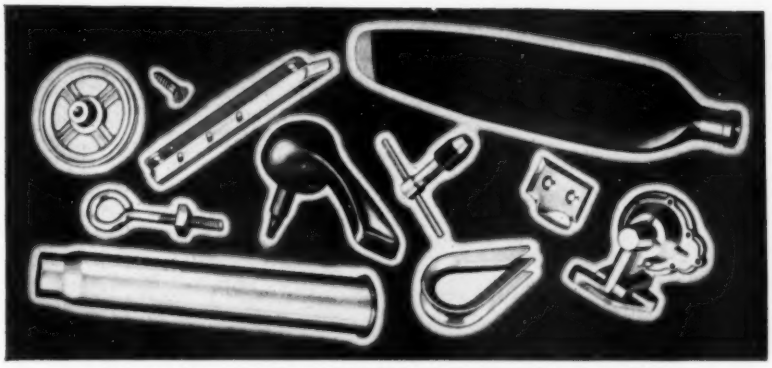

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CHROMATE treating still remains one of the best ways to finish zinc die castings or zinc plated steel. It strengthens corrosion resistance. It's an *easy* way to finish. It's economical. And time has proved its quality.

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Through the unusually wide choice of finishes United Chromium provides, even greater benefits become possible. Here's why. A more economical dip solution may be chosen. Or a production advantage may be realized.

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Brighter finish on zinc plated hardware with less solution-waste was gained in another plant with still another compound.

Chromate treating of zinc plated steel shell cases done electrolytically with Anozinc is found best and cheapest in the long run by many producers.

**HERE IS VARIETY**

Unichrome chromate finishes offer a good color choice. Lustrous, clear bright finish or black—brassy yellow or olive drab—even brass-color—all these can be produced chemically by Unichrome Dip solutions.

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# Branch News

**Coming Events**

## DETROIT BRANCH

The Branch will hold its annual Stag Day Picnic on Saturday, July 31, at the Glenn Oaks Country Club on the outskirts of Detroit.

The day's program includes exclusive use of the golf club and course, games with prizes, free beer and pretzels, buffet style dinner, entertainment and a door prize for everyone. The committee for the affair: R. H. Dudley, United Chromium, Inc., general chairman; advisory, W. L. Pinner, H. E. Head; publicity, J. C. Drinkwater; tickets, J. F. Siefen; prizes, Manuel Ben; parking, C. Borlet; athletics, W. Wilson; dinner, D. Bigge; finance, C. C. Conley; ex-officio members: J. Gurski, L. Borchert.

Almost 900 members and guests attended last year's Stag Day, so orders should be in early for assurance of tickets. Tickets may be obtained from John F. Siefen, 5657 Lauderdale in Detroit.

See you on the 19th hole!

John Drinkwater,
*Publicity Chairman*

## BRIDGEPORT BRANCH

A regular meeting was held on April 9 in the main ballroom of the Hotel Barnum.

President Consalvo called the meeting to order at 8:20 P. M. at which time 48 members and guests were present.

The following were elected to office for the coming year:

*President*—Phil Bailin
*1st Vice-President*—J. Simon
*2nd Vice-President*—R. Bonazzo
*Librarian*—F. Tatum
*Secretary-Treasurer*—R. Parker
*Sergeant-at-Arms*—Al Ferguson
*Board of Managers*—W. Ehrencrona, Ray Goral and H. Braun
*Delegates*—C. Eckholm, Frank Kalafus, and Robert Bonazzo
*Alternates*—J. McCarthy, W. Ehrencrona and V. Consalvo

V. Consalvo, retiring president, turned over his duties to the incoming president, Phil Bailin. Bailin's first official duty was to present Consalvo with a past president's pin.

Applications for membership were received from: Evan H. Silos of the Burndy Engineering Co., Inc.; Edward P. Dawber of the Hanson-Van Winkle-Munning Co., and John O. Tychanich of Roberts Rouge Co.

John Shamiss was voted into Society membership.

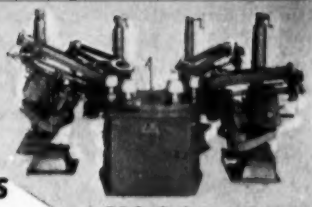
Bailin then presented Frank Eddy, Waterbury Branch member. Eddy is a candidate for the office of 3rd Vice-President of the National Society.

The meeting then was turned over to Bob Bonazzo, who introduced Wes Cassell of Lea Mfg. Co., who in turn intro-

# ACME *Rotary Automatics*

## . . . cut costs on production finishing

536-145



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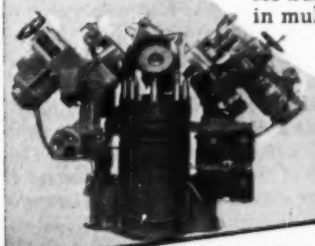

536-149

RECOMMENDATIONS and QUOTATIONS . . . will be offered on receipt of blue prints or preferably finished and unfinished parts you contemplate finishing, together with details of your present finishing operations and production requirements.

SPECIAL MACHINERY AUTOMATIC BUFFING MACHINES

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*Builders* OF AUTOMATIC POLISHING AND BUFFING MACHINES FOR NEARLY HALF A CENTURY

## Branch News

duced ELLSWORTH T. CANDEE the evening's featured speaker. Candee's subject was "The Advantages of Liquid Spray Buffing Compounds."

Cassell was host for the evening's excellent refreshments that were served after the talk was concluded.

ROBERT PARKER, *Secretary-Treasurer*

### CAPITOL DISTRICT BRANCH

At the May 3rd meeting, 41 members and guests enjoyed a roast beef dinner at Panetta's Restaurant in Menands, N. Y.

PRESIDENT INFIELD conducted a business meeting. The secretary read minutes of previous meeting followed by a treasury report that indicated we are solvent (TREASURER W. J. BECKER). New members elected were: GEORGE E. KOCHEM, COY A. JEWEL, NICHOLAS J. CILBERTI, and GEORGE J. MATSON.

DR. D. GARDNER FOULKE of H-VW-M spoke on "Silver Plating"—a talk which was well received as evidenced by the large number of questions that followed.

CHARLIE BRIDGETT of H-VW-M was host for refreshments after the meeting was adjourned.

P. D. CALLAHAN, *Secretary*

### CINCINNATI BRANCH

The April 28 meeting was called to order by PRESIDENT TRUMAN at 7:45 P. M. with 33 members and guests present.

A movie, "Polyester for Prescription," showed the manufacture of resin bonded Fiberglas products.

A discussion was held concerning the possibility of having the National Convention in Cincinnati in 1958 or as soon thereafter as possible.

Young presented the following applications for membership: THOMAS A. MCCAMMON, ROGER E. WINTERMAN, ROBERT B. PRESTON, HAROLD E. SIGWELL, and EDMUND C. HUXLEY. All 5 applicants were seated in as members of the branch.

President Truman introduced DR. H. J. WIESNER of the Bendix Aviation Corp. as the speaker of the evening. Wiesner gave a very interesting and informative talk on "Stresses in Electrodeposits."

A discussion was held on the cause and the means of relieving of stresses in plated deposits. Wiesner mentioned that the superimposition of a-c on d-c relieves stresses and that occlusions can be responsible for high stresses.

AUBREY HOLT reported the results of the balloting for branch officers for the coming year as follows:

*President*—WILLIAM D. GORDON
*1st Vice-President*—CHARLES R. SORBER
*2nd Vice-President*—ROBERT K. RARICK
*Librarian*—W. WILSON LOVELESS
*Board of Managers*—CHAS. E. FOERTMEYER
*Secretary*—L. J. HOWALD
*Treasurer*—GORDON T. SPEERS

President Truman announced that the incoming president would appoint a delegate to replace E. A. BLOUNT who had to resign because of business reasons.

W. W. LOVELESS reported on the Tri-State Regional meeting and thanked everyone for their help.

The evening's social hour was sponsored by The Detrex Corporation.

WILLIAM YOUNG, *Secretary*

### CLEVELAND BRANCH

On March 5, the following were elected as officers for 1954–1955:

*President*—HENRY FRIEDBERG
*1st Vice-President*—JUSTIN EMLICH
*2nd Vice-President*—ARTHUR DUROSE
*Secretary-Treasurer*—A. J. LUPIEN
*Librarian*—ED ROEHL
*Asst. Librarian*—MORT VAN LOAN, JR.
*Board of Managers*—JACK LITTLE

The Board of Managers now consists of the following: Jack Little, HARRY POCHAPSKY, and HOWARD BLOUCH.

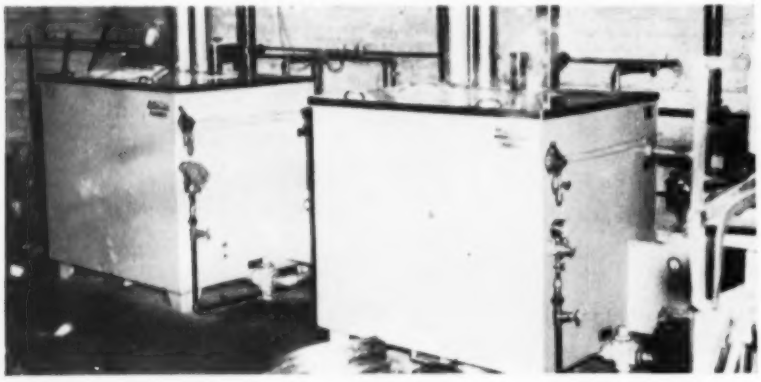
The meeting of April 2 was held as usual at the Carter Hotel. Due to the large attendance of more than 100 members and guests, it was necessary to use a larger meeting room than normal. The speaker of the evening and the reason for the large attendance was WALTER PINNER. The subject was "Polishing and Its Effect on the Corrosion Protection of Decorative Deposits."

Following the talk, W. SCOTT installed the branch officers for the coming year.

The applications for 7 new members were read and accepted.

Following a short business meeting, refreshments were furnished through the courtesy of Hanson-Van Winkle-Munning Co.

A. J. (BERT) LUPIEN, A. H. DUROSE

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## HARTFORD BRANCH

At the regular meeting held at the Bond Hotel on April 19, about 73 members and guests were present. Preceding the meeting a color movie entitled "Microcast" was shown.

Guest speaker for the evening was JACK SWIFT, President of the Swift Industrial Chemical Co., whose subject was "What the Plater Should Know About Metallurgy."

Swift spoke briefly on basic metallurgy describing the composition of steel; how it is made; and equipment used to test steel.

HAROLD A. KAHLER was the technical chairman for the evening. The following were installed by ARTHUR LOGOZZO to serve for the coming year:

*President*—EUGENE DOWLING
*1st Vice-President*—JOSEPH MCINERNEY
*2nd Vice-President*—GEORGE COLOMBIE
*Secretary*—STANLEY PLATOZ
*Treasurer*—STUART BEGG
*Educational Advisor*—HARRY SANDERS
*Educational Committee*—WALTER ACKER, *Chairman*, BERNARD COHEN, ARNOLD JOHNSON, THOMAS MCFARLANE
*Board of Managers*—JULIE MADZIK, RALPH CHASE, RALPH MCCAHAN, EMILE BELOIN

STANLEY PLATOZ, *Secretary*

## INDIANAPOLIS BRANCH

Radio Corporation of America in Indianapolis was host to the 45 members and guests of the branch on April 7. Abraham Max presided. As the branch is interested in securing the National Convention at a future date, a representative of the Indianapolis Convention Bureau, Mr. Phillips, was present and gave facts on the bureau's work. He stated definitely that Indianapolis can handle the convention. AL KRIESE, JOHN HOLLAND, JOHN HOOD, and ED BRUCK were appointed as a committee to work with the bureau and report at the next meeting.

Max gave some interesting facts and information about the RCA plant before the start of the record plant tour. He stated that at least 85–90 per cent of all RCA records are made locally.

At the May 5 meeting at Fox Steak House, 40 members and guests attended. Out-of-town guests included PHILIP SMITH of the Detroit Branch.

Al Kriese, chairman of a committee to investigate for a National Convention, gave a fine report. Two questions were asked. One, whether the members were in favor of a convention in Indianapolis and the other, whether they would work on a committee. A vote was much in favor of the above two questions.

Under items of business, John Hood made a motion that the branch give $100 to the Research Fund. This was seconded by MR. SHOCKLEY and passed.

Two applications for membership were presented and accepted. These new members were ROBERT R. MYERS, Perfect Circle Corp., Hagerstown, Ind., and EDWIN C. BRINSON of Allison's, Indianapolis. The annual election was held and the results were as follows:

*President*—ELMER LUNDBERG
*1st Vice-President*—HERBERT KENNEDY
*2nd Vice-President*—BERT HAWBEE
*Secretary*—EDNA ROHRABAUGH
*Treasurer*—CARL NIEHAUS
*Librarian*—ROBERT VAN HOUTEN
*Board of Managers*—JOHN E. VAUGHAN, FREDERICK ANDERSON, JOHN HOOD and ABRAHAM MAX

JOHN HOLLAND, chairman of Paper Committee, reported that along with two additional members on this committee, NELLO ARTERBURN and LOREN STEVENS, they had been investigating possibilities of who might present a paper to the publication PLATING. It was suggested this committee be made a permanent committee and that it be their job to encourage this work.

The program was a general question and answer session led by Al Kriese. One thing about this type program, a member can present a problem that is of interest to him. These problems are most always practical ones. Much participation followed which was very gratifying.

The new president, Elmer Lundberg, was presented.

EDNA ROHRABAUGH, *Secretary*

## LOS ANGELES BRANCH

A regular monthly meeting was held April 14 at the Rodger Young Auditorium with dinner served at 7:00 P. M. PRESIDENT STUART KRENTEL opened the business meeting at 8:05 P. M. with 87 members and guests present.

After the various reports were pre-

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sented and two new members were initiated, the meeting was turned over to the Librarian who introduced the speaker of the evening, RAY LEDFORD, of the Industrial Pump and Filter Co. His subject was: "Methods of Dealing with Plating Room Wastes." Ledford stressed that it was important to reduce the load on the disposal system by reducing the waste production through such means as counter current flow of rinse water, good rack maintenance, allowing time for drainage of parts, and general good housekeeping. He pointed out that it was equally important to control the rate of waste production so that the load on the disposal plant was uniform.

He then discussed various methods of treating wastes to minimize their effect on streams and sewage systems.

CLYDE KELLY, AES 2nd Vice-President, was an honored guest and addressed the meeting concerning changes in procedures at National Headquarters, memberships, and sustaining memberships.

NORMAN K. MCEWAN, *Secretary*

## MILWAUKEE BRANCH

On April 2 the branch held its monthly meeting at the Ambassador Hotel. PRESIDENT FRED ANDERSON gaveled the meeting to order with 56 members and guests.

The nominating committee submitted the following list of candidates for office for the coming year:

*President*—GLEN SCHWEMER
*1st Vice-President*—JOHN SCHNEIDER
*2nd Vice-President*—HERMAN TESSMAN
*Secretary-Treasurer*—CLIFFORD PETER
*Librarian*—ARTHUR LINN
*Board of Managers*—P. RITZENTHALER

Three applicants were accepted as new members. The name of FRANK MARX should have appeared last month as one of those men who were made Honorary Members at the March meeting.

Librarian John Schneider introduced the speaker, JACK LUM, Pennsylvania Salt Mfg. Co., who spoke on the subject of "Mechanics of Phosphate Coatings for Metals." The lecture included ferrous and nonferrous metals.

C. PETER, *Assistant Secretary*

## MONTREAL BRANCH

The regular meeting of the branch was held on April 6 in the Mount Royal Hotel.

The evening's speaker was ALLAN D. RUSSEL, Technical Manager of the Michigan Chrome and Chemical Co. The text of his talk was application of materials, such as wax, tape and lacquers on metal for masking prior to plating. Russel mentioned that all surfaces must be thoroughly cleaned prior to masking.

During a brief business session, one applicant, W. T. SCOTT, was elected to membership. Also delegates for the July convention were nominated.

JEAN MONETTE, *Secretary-Treasurer*

## NEWARK BRANCH

The April 16 meeting, held at the Robert Treat Hotel, was called to order by PRESIDENT JOHN GUMM following the usual presentation of a film by HOWARD COBB; all officers and 31 members attended.

Applications from FLAVIO J. LA MANNA and MALCOLM L. PARKERTON were referred to the Board of Managers and LOUIS M. BROWN and MICHAEL PARISI were elected to membership. ANTHONY F. ROTOLI was transferred to Newark from Syracuse and WILLIAM A. HOPKINS from Detroit, while FRANK X. HULSER, Jr., was transferred to New York and MERRITT J. WARWICK to Philadelphia.

ROYAL CLARK, SR., Honorary Member of Newark Branch and only surviving member that attended the first meeting of the National Electro-Platers' Society of United States and Canada, presented a eulogy to Mr. George B. Hogaboom.

The meeting was turned over to LIBRARIAN CLIFF STRUYK who introduced AL KORBELAK whose timely topic was "Servo Controls in Electropolishing of Wire and Strip."

D. R. MESERVE, Sales Manager, Organic Coating Division of United Chromium Corp., presented the principal paper of the evening—"Organic Coatings in Metal Finishing."

D. G. FOULKE, *Recording Secretary*

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# Branch News

## NEW ENGLAND REGIONAL

Hartford's Bond Hotel saw an overflow crowd of AES members and guests on the occasion of the 15th Annual New England Regional meeting. The affair, sponsored by the Hartford, New Haven, Springfield and Waterbury Branches, featured an exceptionally interesting educational session. Heard during the afternoon were: Dr. Abner Brenner, Chief of Electrodeposition Section, NBS on the topic, "Current Status of Electroless Nickel Plating"; Ezra Blount, Editor of Products Finishing, on "Life in Japan" (accompanied by an 8 mm color movie); and Dr. Wilfred Roth, Treasurer and Director of Research, Ultra-Viscoson Corp., on "Ultrasonics as Applied to Metal Finishing."

After an intermission, sprinkled with gay cocktail parties, the day's program was climaxed with a filet mignon dinner served to an overflow crowd of close to 500.

The committee which deserves an accolade for the splendid program are: Chairman, R. H. McCahan; Vice-Chairman, Julie Madzik; Educational, P. J. Sloane; Financial, E. F. Koetsch, Jr.; Program, R. Heroux; and Entertainment, L. J. Durney.

## NYC "OLD-TIMERS' NIGHT"

May 28

The clock was turned back over a quarter of a century on May 28 when National Past President Franklyn J. MacStoker presided over the branch's "Old-Timers' Night" at the Hotel Statler.

More than 100 members and guests heard program chairman MacStoker pay tribute to the "band of intrepid pioneers who provided the groundwork for an organization which is second to none in the field of international technical societies." "Old-Timers" received handsome gifts on behalf of the branch. Refreshments were served and strains of "Auld Lang Syne" at midnight rounded out a most memorable evening.

J. A. Stremel, W. Voss and H. C. Bernard recalled attending the first regular meeting of the National Association of Electro-Platers at the Hotel Chelsea in New York on April 10, 1909. Related, also, was the story of how 3 years later, members from all over the world met in the third floor front suite of the Broadway Central Hotel in New York to chart the course of the AES and elected George B. Hogaboom its first National President.

There was a sad note in the evening's festivities, however, as Chairman MacStoker, a mainstay of the local branch and one of the AES's hardest workers, read the names of "Old-Timers" who had passed on. A moment of silence was observed in memory of G. B. Hogaboom, B. Popper, H. Levine, B. Nadel, O. Sizelove and H. Smith.

Branch members with over 25 years' membership also were honored and included H. C. Bernard, L. Cates, D. X. Clarin, B. Gross, W. Fischer, S. Goldstein, E. Haas, A. Henry, R. J. Liguori, F. J. MacStoker, I. Mershan, H. Miller, J. Mingfs, P. Morningstar, J. Rolff, W. Schneider, E. Schore, J. E. Sterling, J. A. Stremel, T. A. Trumbour and W. Voss.

In a brief meeting which preceded "Old-Timers' Night" President A. Amatore introduced Plating Advertising Manager, H. G. Burnley and AES Executive Secretary, P. P. Kovatis.

## PITTSBURGH BRANCH

The regular monthly meeting was held on April 7 when 3 new members were welcomed into the branch. They were Louis Paulish, Armand Maban and Richard Woehrle. The applications of John K. Sargent and Grant H. Brundge were received for membership.

Dr. Henry Brown, Research Director of the Udylite Corp., was speaker for the evening. His subject, "Corrosion Study of Various Chromium Plated Electrodeposits," was a very interesting one. Brown illustrated his fine talk with slides.

Librarian Myron Ceresa presided over a very lively question and answer period.

Many of his friends will be happy to know that Past President Rex Goldbach will be married June 24, 1954 to Miss Barbara Mahoney.

Wm. D. Wilson, *Secretary*

*Last minute detail's being checked for the 15th Annual New England Regional. The group, left to right: Perry Sloane, Spencer Henn, Gene Dowling, Julie Madzik, Jack Costigan, Ralph McCahan and Stanley Platoz*
*(Plating photo)*

*Drs. Abner Brenner and Wilfred Roth, two of the speakers at the 15th Annual New England Regional meeting held recently at Hartford, Conn.*
*(Plating photo)*

*New York Branch "Old-Timers" honored on May 28. Front row (l. to r.): William Schneider, Elias Schore, William Voss, Ben Cross, Sam Goldstein. Back row (l. to r.): Ralph Liguori, Dr. Louis H. Cates, John Rolff, David X. Clarin, Harry C. Bernard, National Past President F. J. MacStoker, Justice A. Stremel*

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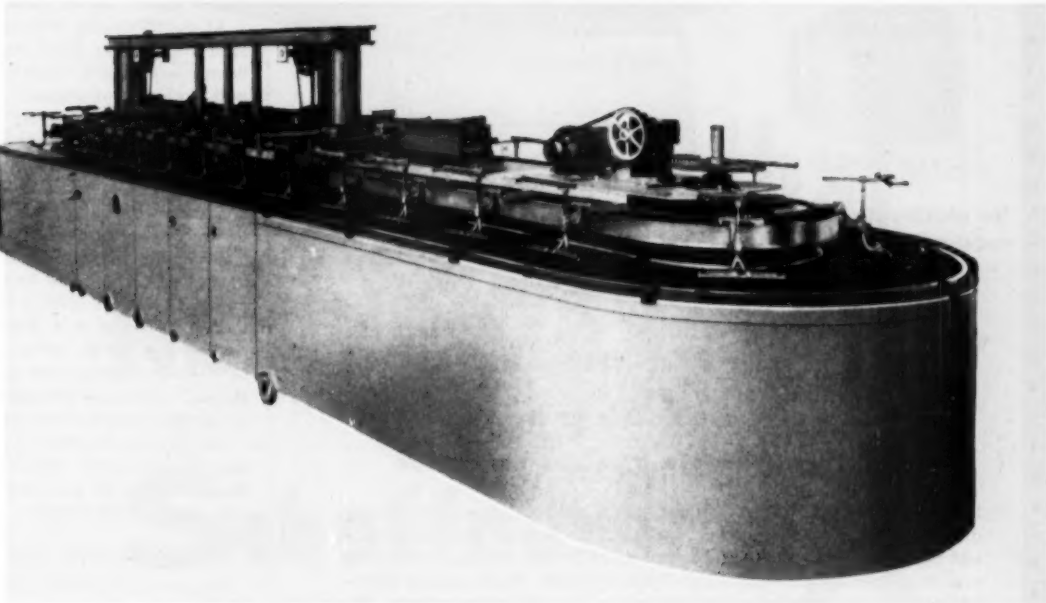

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**brightens zinc die castings by chemical polishing, protects against corrosion**

**NOW, FOR THE FIRST TIME** you can get a brilliant, decorative finish directly on zinc die-cast parts . . . without mechanical finishing, without electroplating! The luster is provided by the *chemical polishing* action of new Iridite (Cast-Zinc-Brite) solution. Even surface blemishes, such as cold shuts, are brightened by this new process. No electrolysis. No special equipment. No specially trained personnel. Just a simple chemical dip for a few seconds and the job is done. And, this new Iridite has been *tested and proved* in production.

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## Branch News

### ROCKFORD BRANCH

The branch held its annual Educational Session and Banquet on Saturday, April 3, in the afternoon and evening, at the Faust Hotel in Rockford; 132 people were present to hear the afternoon speakers. GEORGE CARLSON, president of the Acme Mfg. Co., discussed the films that showed the operation of automatic buffing machines manufactured by his company.

BILL JACKSON of the Udylite Corp. talked about "Barrel Plating."

At the conclusion of these two talks, a brief respite was taken and coffee and donuts were served. This innovation was well-received and aroused much favorable comment. It is heartily recommended that other branches investigate this means of breaking up a lengthy afternoon.

CLYDE KELLY, AES 2nd Vice-President and the afternoon's chairman, managed to draw his own number out of the box and win the door prize. He must have learned how to do this from the "Great Houdini"—it was quite a trick.

S. J. FECHT of S. J. Fecht and Associates concluded the afternoon by talking on "Work Simplification in the Plating Room." This topic was handled ably and is one that bears looking into by all.

The day was concluded by the banquet and dancing, with 313 in attendance. Sincere thanks are due to the able chairman, ELLSWORTH BUDDEN.

### ROCHESTER BRANCH

For the April meeting, the branch convened at the 40 & 8 Club. The meeting was devoted entirely to branch business and the agenda included the following: announcement that the proposed Rochester Branch bylaws were approved by the Society Law Committee, thereby making them the official rules of the branch, prior approval having been granted by branch members; a slate of officers for 1954-1955 was presented by the nominating committee to be voted upon at the next branch meeting; and plans for the May meeting were revealed by RAY BERGHOLD.

ED WALLIN, *Secretary*

### SAGINAW VALLEY BRANCH

The April 14th meeting, attended by 70 members and guests, was held in the Colonial Room of the Zehnder Hotel in Frankenmuth, Mich., and was preceded by a delicious chicken dinner.

Outgoing PRESIDENT MANUEL BEN opened the meeting and presented the chapter gavel to incoming PRESIDENT GEORGE H. CARTER. President Carter's first matter of business was the presentation of an engraved honorary gavel to Manuel Ben.

The door prize, a casting rod donated by RICHARD MCALEER of Formax, was

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## Branch News

won by FRANCIS J. ASSELIN of Chevrolet-Bay City Division of General Motors, Corp.

VIRGIL V. SABOURIN, Process Engineer of the Saginaw Steering Gear Division of General Motors, was suggested for membership and the motion carried.

The topic for the evening, "Treatment of Plating Waste—Large and Small," was presented by GEORGE A. MCBRIDE, District salesman and engineer, Infilco Co.

D. R. MALTHANER,
*Recording Secretary*

### SAN FRANCISCO BRANCH

A special meeting was held at the Leamington Hotel, Oakland, on March 18 to accommodate ROBERT COUCH, Manager of Technical Development, United Chromium, Inc., Detroit, Mich. Couch spoke on interesting new high lights in chromium plating.

The regular March meeting was held on the 25th at Larry's Restaurant in San Francisco.

Speaker that evening was MYRON DIGGIN, Hanson-Van Winkle-Munning Co., and he talked on unusual plating problems and plating facts in general.

The following officers were elected:

*President*—EDWARD KETTMAN
*1st Vice-President*—HOWARD J. LACKEY, JR.
*2nd Vice-President*—L. L. PEART
*Secretary-Treasurer*—FLOYD W. BROWNING
*Librarian*—HORACE J. SMITH
*Board of Managers*—FRED W. HUNTINGTON, JACK ULRICH, J. R. PATTENGER

RICHARD A. WHITBECK was voted into membership.

The April 15th meeting was held at the Hotel Leamington, Oakland.

First speaker was RAY LEDFORD of the Industrial Filter & Pump Co. His subject was "Controlling Waste in the Plating Room." Ledford elaborated on various methods of treating acid and alkalis prior to discharging, and he pointed out the use of ion exchangers as the best mechanical means for the recovery of chromic acid.

Second speaker for the evening was CLYDE KELLY, AES 2nd Vice-President. He pointed out the importance of cooperation between members, shop operators and employers, also the many ways the branches could enlarge their membership, such as speakers within their branch, securing good publicity, social clubs, regional meetings, and increasing our sustaining membership.

The following applicants were voted into membership: J. E. COSGRAVE, HERBERT J. DUPRE, and JOHN FESTA.

HORACE J. SMITH
FLOYD W. BROWNING
*Secretary-Treasurer*

### SOUTHEASTERN BRANCH

At the March 12th meeting, 12 members were present. Results of mail balloting for officers were given by SHORTY AUTRY. The following are to serve for the coming year:

*President*—RAY STEFFEY
*1st Vice-President*—CLYDE STOVALL
*2nd Vice-President*—WM. KELLEY
*Secretary*—BILL WEYMOUTH
*Librarian*—CLEM HOHNER

New officers present were introduced and gave brief talks. Clem Hohner as Librarian also will take on the special job of seeing that recognition is made in PLATING of all speakers particularly out-of-town men; and also in other magazines printing plating news. Discussion was held on attendance by Autry, STOGNER and Steffey.

The April 7th meeting was held at the Belmont Steak House, with 38 members and guests present.

Speaker of the evening, presented by Librarian C. H. Hohner, was R. A. (DICK) FELLOWS, of the Udylite Corp., Detroit, Mich. He gave a very informative talk on basis metals for plating, particularly stressing the types and conditions of steel.

W. T. WEYMOUTH,
*Secretary-Treasurer*

### SPRINGFIELD BRANCH

The May 24th meeting was opened at 10:00 P.M. by PRESIDENT PHILIP W. SANDERS.

WAYNE SANDERS made the presentation speech after which EDWARD KOETSCH received his Past-President's silver pin.

ROBERT GIRARD made a motion to confer on JOHN E. COSTIGAN an honorary lifetime membership in the Springfield


guard against Rejects

"Sealed-Disc" Filters were designed especially for plating rooms. They're smaller, compact, and more portable than ordinary conventional Filters, and they are also performing satisfactory results on many acid dips, electro cleaners and solvents.

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More and more cost-minded platers depend on Alsop *"Sealed-Disc"* Filters to remove dirt, dust, and sludge from their plating solutions. They get better finished plated work, they save time and labor, and their plating solutions last longer. The *"Sealed-Disc"* Filter assures positive, trouble-free performance that's proof against even the invisible impurities that cause nodules and porousness, proof against rejects and reworking. There's a *"Sealed-Disc"* Filter *"to fit your job"*—write for complete information, the Alsop Engineering Corporation, 907 Fine Street, Milldale, Connecticut.

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Branch for his exemplary service to the Society. The motion was passed, and the Secretary was instructed to mail a copy of the minutes to Costigan.

It was decided that the Board of Managers hold a midsummer meeting on a Monday evening at 7:00 P.M., at a place and date to be decided.

Librarian Charles F. Griffin, Jr., showed color movies on hunting and fishing after which the meeting adjourned.

Roger Heroux, *Secretary*

### ST. JOSEPH VALLEY BRANCH

The April 7th meeting was held at the Hotel Elkhart, Elkhart, Ind. This was the yearly Ladies' Night meeting and a total of 50 members and their ladies attended the dinner. Door prizes were awarded to Mrs. Frank Weaver and Mrs. Charles Hill. Each member and guest present also received a gold picture frame favor.

Since there were no nominations from the floor, a unanimous ballot was cast for the election of the candidates as presented by the nominating committee. New officers will be installed at the May meeting.

Ralph Brouwer, branch 2nd Vice-President and Ladies' Night Chairman, then introduced the speaker of the evening, William Bettison, sales engineer for Haviland Products Co. The talk was a travelogue on his recent stay in Jugoslavia, Trieste and the Balkan countries and was illustrated with some unusually fine color slides.

The last regular meeting of the season was held at the Hotel Elkhart, on May 5, when 51 members and guests enjoyed the dinner and 54 attended the panel discussion.

President William McDowell called on John Lockerbie to install the officers for the new year. In his usual fashion, Lockerbie called each new officer and with a handshake and proper instructions to each officer, installed each man in his new office.

The new president, John Bayman, then introduced Duke Wysong, as moderator of the panel discussion. Wysong then installed the panel of experts for the evening—Frank Savage, Joe Haviland, and Harold Wiesner. There followed several questions and answers. (These will appear in the Question Box column of this journal so that fullest advantage of their value can be taken.—Editor.)

Eugene Roth,
*Secretary-Treasurer*

### SYRACUSE BRANCH

At the April 19th meeting, held at Bill Richard's Restaurant, there were about 40 members and guests at dinner and about 60 present when the business session began.

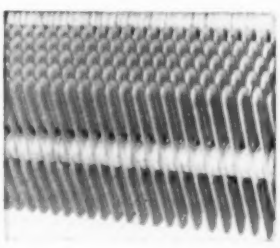
*Dan Gray (center) congratulates Vince McConnell, new Syracuse Branch prexy at recent meeting. Photo shows, left to right: Al Korbelak, Dr. Samuel Moskowitz, Gray, McConnell and P. Peter Kovatis* (Plating *photo*)

A high light of the evening was the installation of the new branch officers for the coming year.

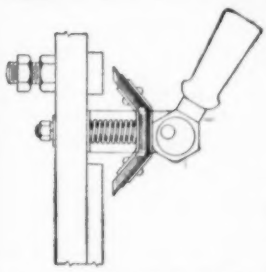
Featured during the meeting were three speakers—two from Society Headquarters. P. Peter Kovatis, Executive Secretary, spoke on "Facts About Your AES" and Al. Korbelak, Plating's editor, presented a topic, "Across the Editor's Desk." The main speaker of the evening was Dr. Samuel Moskowitz,


**Two excellent reasons why you should use COLUMBIA TANK RHEOSTATS**

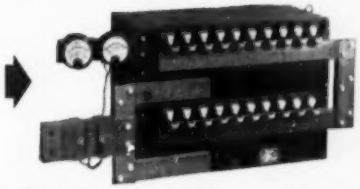
**1 CAST GRID RESISTORS**



**2 TOGGLE SWITCHES**



Here are two outstanding construction features of Columbia Tank Rheostats: (1) *Cast Grid Resistors*, rugged, resistant to chemical fumes, capable of withstanding intermittent and momentary overloads. (2) *Toggle Switches*, easily operated, self-cleaning, cam type to give a quick break and a positive contact. Consider these and other important Columbia features when selecting tank rheostats to give long life service and effective plating control.



Standard sizes from 15 to 5000 amperes, 1 to 6 volt drop. Other voltage drops as specified. Furnished complete with voltmeter, ammeter and shunt. Short Circuiting Switch available.

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Bright, clear, decorative finishes or iridescent and color coatings to meet the toughest corrosion resistance requirements on zinc plate and zinc-base die castings.

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Brilliant finish and outstanding corrosion protection on cadmium.

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Golden protective finish for magnesium.

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L-12

THE Chemical CORPORATION
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chemical engineer of the Division of Industrial Hygiene, Department of Labor, State of New York.

Following a spirited question and answer period, refreshments were served through the courtesy of Ed Elliott and Frederic B. Stevens, Inc., Detroit, Mich.

Lindley S. Wood, *Secretary*

### TWIN CITY BRANCH

The branch met on April 5 at 7 P. M. in the Lodge Room of the Covered Wagon Cafe in Minneapolis with 45 persons present. Following dinner, President Paul Hesse, General Mills, introduced the following guests: Gail Crist, Twin Cities Arsenal; Ruben Paulson, Minneapolis Moline Co.; Bob Montressor American Rack Co.; Orville Wilson, Jos. Wolkerstorfer Co.; Jay Fischer, Universal Plating & Rustproofing Co.; and Larry George of the Udylite Corp.

Gordon Zimmerman of L & K Plating Co. was introduced and welcomed into the branch as a new member.

Jerome M. Weller, Minneapolis Honnywell Regulator Co., chairman of the cominating committee, presented the following slate of officers, who were elected promptly:

*President*—G. C. Reed
*1st Vice-President*—F. Kiam
*2nd Vice-President*—R. Teply
*Librarian*—R. J. Bierman
*Secretary-Treasurer*—R. L. Buckley
*Board Members*—Paul Hesse, E. H. Lindemann, Warren Johnson

Following the business meeting, the meeting was turned over to Librarian Bob Teply of Northwest Airlines and then to Elmore Relitz of United Chromium, Inc., who spoke on "The Self Regulating High-Speed Chrome Bath."

Robert L. Buckley,
*Secretary-Treasurer*

### WATERBURY BRANCH

A regular meeting was held on April 8 in the Colonial Room of the Hotel Elton. After a dinner preceding the meeting, President Eddy thanked the members and officers for their cooperation during his tenure of office. He then introduced a veteran Waterbury member, Bill Starr, who installed the incumbent officers.

Perry Sloane, the new president, took over the meeting and introduced Ted Voyda, technical chairman, who called on Dr. George Dubpernell for the book review. Dr. Dubpernell briefly described "Moderne Galvanotechnik" by Machu. Translated, this means Modern Electroplating. It was felt not to be up to the standard of Gray's "Modern Electroplating."

The speaker of the evening, Walter H. Prine, chemical engineer, International Nickel Co., gave a technical talk entitled "Industrial Nickel Plating."

William P. Innes,
*Publicity Director*


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- the process provides high speed plating characteristics (Hull Cell 0-100 amperes per square foot with agitation 18 feet per minute) and at ROOM TEMPERATURE. This high speed feature will enable you to produce more work from existing equipment.
- deposits are bright.
- deposits are soft and ductile and can be heavy; in some cases, deposits as thick as 0.060" are being produced.
- deposits have higher tarnish resistance than those from conventional silver plating processes.
- can also be used for barrel plating.
- adaptable for many decorative as well as industrial applications.
- further, your existing silver solutions can easily be converted.

Bear in mind that we're not asking you to be the guinea pig. Lea-Ronal Bright Silver Process 3K has been fully production-tested in both still tank and barrel operations. Further, you won't have to start fresh, so to speak. You can start with your existing silver solutions.

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# *Membership Report of the AES*

### Elections

**BALTIMORE-WASHINGTON:** Edward C. Bertucio, Samuel D. D'Alfonzo

**BRIDGEPORT:** Emil Bergen, Stephen Imrischak, Jr., John Morriss, John Shamiss

**BUFFALO:** John R. Boylan, Richard D. Taylor, J. L. Martin

**CAPITOL DISTRICT:** Wilson J. Becker, Walter C. Bentley, Sr., Nicholas J. Cilberti, James W. Eastham, Vito P. Greco, Herbert T. James, Alfred L. Jenny, Coy A. Jewel, George E. Kochem, George J. Matson, Adam Osielski, Rocco Robelotto, Charles Schenk, Jr., James E. Snare

**CHICAGO:** Robert G. Beaman, Emerich Bechtold, Anthony F. Castle, George W. Egger, Milton C. Johnson, C. W. Jordan, Jr., Richard W. Landon, Ralph E. Miller, Henry F. O'Reilly, Carl Tamboli

**CINCINNATI:** Edmund C. Huxley, Thomas A. McCammon, Robert B. Preston, Harold E. Sigwell, Roger E. Winterman

**CLEVELAND:** L. D. Barrett, Charles A. Bonn, Cameron C. Elliott, Russell F. Getson, Gardner Greene, Herbert E. Hafele, A. P. Keller, Wayne A. Kruper, Harold E. Sliney

**DAYTON:** Byron H. Jacoby

**DETROIT:** J. T. Bell, Noah L. Brisendine, Gene Clements, Frederic W. Cole, Revere G. Counselman, Russell H. Cullen, Valentine E. Diehl, Melvin A. Fellows, Vernon P. French, Henry J. Jeffers, John G. Khoury, Michael J. Kushner, Louis Labovitz, Nick Novikoff, William J. Pierce, Edward Prozaki, Fritz K. Streuer, Dan Trivich, Irving Walch, Marlin Wallace

**GRAND RAPIDS:** Chester Lomasiewics, Elwood E. McCune, William Mooney

**HARTFORD:** Herbert J. Browne, Clayton E. Dutton, Robert C. Michaud, Alex E. Phillips, Kenneth A. Sloan, Sr.

**JACKSON-LANSING:** Vern W. Irey, Robert T. Minshull, Lloyd T. Pearce, John Woodley

**KANSAS CITY:** James J. McNeill

**LOS ANGELES:** Henry E. Duke, Charles Hanson

**LOUISVILLE:** Nathan C. McCune, Harold M. Switzer

**MELBOURNE:** M. Kamlet, P. Major, N. Tucker

**MILWAUKEE:** Raymond R. Harp, Russell K. Irvine, L. B. Lattin, Richard R. Merrill, Leonard J. Quick, Edward J. Weiss

## Membership Competition

| BRANCH | Membership April 1, 1954* | New Members | Net Change in Membership | Per Cent Net Change | Sustaining Membership Credits* |
|---|---|---|---|---|---|
| **First Group** | | | | | |
| Milwaukee | 175 | 12 | + 9½ | + 5.4 | 8 |
| Pittsburgh | 139 | 5 | + 6 | + 4.3 | 5 |
| Cleveland | 246 | 10 | +10 | + 4.1 | 18 |
| Detroit† | 598 | 21 | +17 | + 2.8 | 55 |
| Bridgeport | 154 | 4 | + 4 | + 2.6 | 4 |
| Chicago | 483 | 11 | + 9½ | + 2.0 | 85 |
| Grand Rapids | 168 | 3 | + 3 | + 1.8 | 13 |
| Melbourne | 167 | 3 | + 2 | + 1.2 | .. |
| New York | 385 | 6 | + 4½ | + 1.2 | 19 |
| Hartford | 163 | 5 | + 1 | + 0.6 | 5 |
| Los Angeles | 277 | 2 | + ½ | + 0.2 | 14 |
| Philadelphia | 217 | 1 | − 1 | − 0.5 | 11 |
| Toronto | 136 | .. | − 1 | − 0.7 | .. |
| Boston | 148 | .. | − 2 | − 1.4 | 6 |
| Newark | 276 | 2 | −10 | − 3.6 | 11 |
| Waterbury | 135 | 1 | − 6 | − 4.4 | 16 |
| Syracuse‡ | 159 | 2 | − 8½ | − 5.3 | 5 |
| **Second Group** | | | | | |
| Saginaw Valley | 105 | 6 | + 6 | + 5.7 | .. |
| Cincinnati | 88 | 5 | + 5 | + 5.7 | 2 |
| San Francisco | 76 | 4 | + 3½ | + 4.6 | .. |
| St. Joseph Valley | 81 | 3 | + 3 | + 3.7 | 4 |
| Baltimore-Washington | 100 | 2 | + 2 | + 2.0 | 4 |
| Buffalo | 103 | 3 | + 2 | + 1.9 | 1 |
| Rockford | 78 | 1 | + 1 | + 1.3 | 3 |
| Dayton | 87 | 1 | + 1 | + 1.1 | 3 |
| Rochester | 98 | 2 | + 1 | + 1.0 | 3 |
| Indianapolis | 115 | .. | ..... | ..... | 1 |
| Lancaster | 73 | .. | ..... | ..... | 2 |
| New Haven | 93 | .. | ..... | ..... | 7 |
| Providence-Attleboro | 92 | .. | ..... | ..... | 2 |
| Sydney | 81 | .. | ..... | ..... | .. |
| Twin City | 73 | .. | ..... | ..... | 2 |
| St. Louis | 84 | .. | −½ | − 0.6 | 10 |
| Montreal | 88 | .. | − 1 | − 1.1 | 1 |
| **Third Group** | | | | | |
| Springfield | 67 | 7 | + 5½ | + 8.2 | 2 |
| Jackson-Lansing | 46 | 4 | + 3 | + 6.5 | 1 |
| Louisville | 37 | 2 | + 2 | + 5.4 | 2 |
| Kansas City | 46 | 2 | + 2 | + 4.4 | .. |
| Southeastern | 47 | 3 | + 2 | + 4.3 | 1 |
| Western Ontario§ | 28 | 1 | + 1 | + 3.6 | .. |
| Adelaide | 53 | .. | ..... | ..... | .. |
| Allentown-Reading | 49 | .. | ..... | ..... | 6 |
| Columbus | 60 | .. | ..... | ..... | 1 |
| Dallas-Fort Worth | 54 | .. | ..... | ..... | .. |
| Hamilton | 28 | .. | ..... | ..... | 4 |
| Portland | 18 | .. | ..... | ..... | .. |
| Toledo | 57 | .. | ..... | ..... | 3 |
| Wichita | 34 | .. | ..... | ..... | 2 |
| Houston | 42 | .. | − 3 | − 7.1 | 1 |
| **Outside Competition** | | | | | |
| Capitol District | ... | 14 | +15½ | ..... | .. |
| San Antonio | ... | 11 | +13½ | ..... | .. |
| Southern Tier | ... | 5 | + 5½ | ..... | .. |
| At Large | 157 | 2 | −23½ | ..... | .. |
| **Total AES** | 6,364 | 164 | +174 | + 1.2 | 358 |

Active Membership, May 31, 1954 ..... 6,438

*Subject to correction. †, ‡, §Winners in first, second and third groups, respectively of 1953–1954 membership competition.

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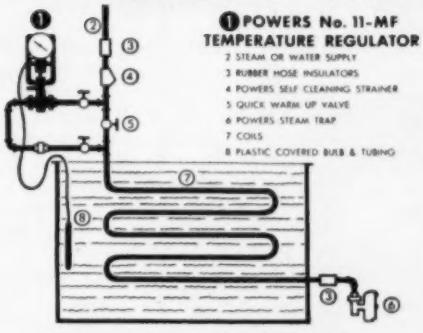
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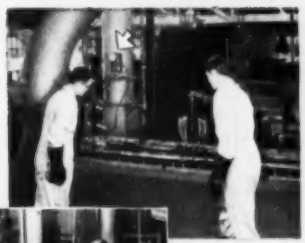

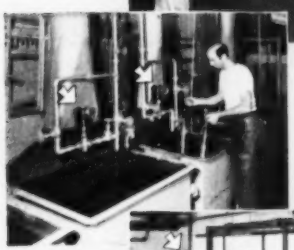

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**ROCHESTER:** Rollin W. Furguson, Edward S. Penczek

**ROCKFORD:** Glen L. Cox

**SAGINAW VALLEY:** Walter A. Crowley, Ralph R. McGaw, Harry E. Moser, Virgil V. Sabourin, Jr., Claude L. Shultz, Arthur A. Somers

**ST. JOSEPH VALLEY:** Louis H. Achberger, Jr., George H. Horne, Henry A. Meers

**SAN ANTONIO:** George Altgelt, Thomas H. Collard, Jr., W. A. Jennings, Philip A. Lorentz, Eduardo Munoz, William Nagel, Jr., Talmadge M. Phipps, Wilbon O. Phipps, Humbert T. Ruiz, Pete Trevino, Horace V. Wells

**SAN FRANCISCO:** John E. Cosgrave, Herbert J. Dupre, John V. Festa, Richard A. Whitbeck

**SOUTHEASTERN:** Richard R. Russell, Frank N. Young

**SOUTHERN TIER:** Charles G. Bound, William P. Karski, Vincent T. Maxian, Stanley C. Stefanski, George P. Zurenda

**SPRINGFIELD:** Roger S. Eddy, Adalor T. Granger, William J. Grover, Jr., Thomas Horrocks, Harry H. Johnson, Eugene F. La Palme, Edgar F. Monat

**SYRACUSE:** Joseph P. Early, Gordon B. Hitchcock

**WATERBURY:** Evan M. Jones, Jr.

**WESTERN ONTARIO:** Mark R. Kirk, Donald C. Thompson

**MEMBER-AT-LARGE:** Dr. Ir. Clara Henderina de Minjer, Eindhoven Netherlands; Paul E. Ritt, Arlington, Va.

### Reinstatements

**CHICAGO:** Louis Duncan

**CLEVELAND:** Steven Tachovaka

**DETROIT:** Arthur M. Brewer

**KANSAS CITY:** Ace Martin (Suspended in error)

**MILWAUKEE:** Lester Birbaum, S. R. Borucki, William R. Cunningham, Arwin Piepenhagen, Richard Servatius, Elmer Wentorf

**SOUTHEASTERN:** R. E. Norman

### Transfers

William Hanford from Springfield to Capitol District; Chester J. Klimek from Springfield to Capitol District; Edward V. Raymond from Springfield to Capitol District. E. C. Bosl from Milwaukee to Chicago; Russell E. Reynolds to Pittsburgh from Detroit; J. Brown to San Antonio from Houston; A. D'Amico to San Antonio from Houston; G. Krone to San Antonio from Houston; Roy Rogers to San Antonio from Houston; James Weaver to Dallas-Fort Worth from Houston; W. Wisdom to San Antonio from Houston; Charles J. Owen to Pittsburgh from Jackson-Lansing; Joseph H. Hesch from San Francisco to Los Angeles; J. Fullerton to Toronto from Montreal; David Mainland to Toronto from Montreal; William A. Hopkins from Detroit to Newark; Frank X. Hulser to New York from Newark; Anthony F. Ritoli from Syracuse to Newark; Merritt J. Warwick, Jr., to Philadelphia from Newark; Chester W. Smith to Lancaster from Philadelphia; Harold Shinall to Dallas-Fort Worth from St. Louis; Eric A. Berical to Capitol District from Syracuse; Leonard Brightman to Capitol District from Syracuse; Nicholas Calentone to Capital District from Syracuse; Paul D. Callahan to Capitol District from Syracuse; Victor Capogna to Capitol District from Syracuse; Joseph G. Donadio to Capitol District from Syracuse; Raymond K. Dunlevy to Capitol District from Syracuse; T. F. Duvall to Capitol District from Syracuse; John H. Green to Capitol District from Syracuse; Robert H. Hill to Capitol District from Syracuse; Merle Inrie to Southern Tier from Syracuse; F. A. Infield to Capitol District from Syracuse; Stephen E. Koziar to Capitol District from Syracuse; Harry F. Millis to Capitol District from Syracuse; William O. Naylon to Capitol District from Syracuse; John J. O'Connor to Capitol District from Syracuse; Edwin E. Wheeler to Capitol District from Syracuse; Wendell L. Plummer to Southern Tier from Member-at-Large

### Resignations

**BUFFALO:** O. A. Short

**CHICAGO:** A. G. Russell, A. Seligman

**DETROIT:** Walter B. Byers, Alfred T. Dunn, Arthur E. Schneid,er Sam Sgriccia

**GRAND RAPIDS:** Robert O. Bennett

**HARTFORD:** Joseph E. Jacob, Robert Sanford

**JACKSON-LANSING:** C. E. McDowell

**LOS ANGELES:** P. A. Boeck, Jule H. Born, John S. Hunter, Sr.

**MELBOURNE:** A. Sungaila

**MILWAUKEE:** G. F. Feltz, R. L. Hundley

**NEW YORK:** Ralph Ayala, Seymour Lieberman, W. H. Robinson

**PHILADELPHIA:** C. Luther Fuelling, Louis R. Reckner

**ROCHESTER:** Arthur A. Chambers

**ST. JOSEPH VALLEY:** Hugh Huppert

**SOUTHEASTERN:** Fred W. Cox, Jr., Frank O. Bates, W. Gray Hampton, Francis S. Webster

**SYRACUSE:** R. N. Hitchcock, Edward Noxon

**WATERBURY:** Leo J. Bakinow, Charles I. DeBisschop, William Macristy, Frank J. Severin, William F. Whitty, George R. Wilson, Jr.

**MEMBER-AT-LARGE:** Oswald Boyd, Sunderland, England; Bernard B. Workman, London, England

### Suspensions

**BOSTON:** James A. Dugan, A. H. Gower

**GRAND RAPIDS:** Jack D. Weerstra (Armed Forces)

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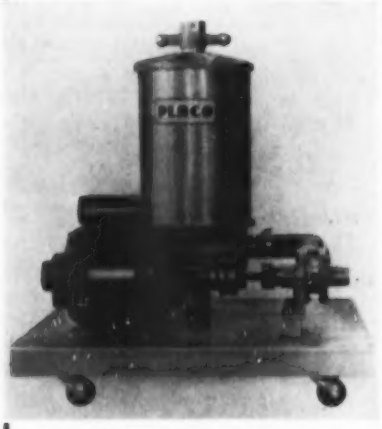


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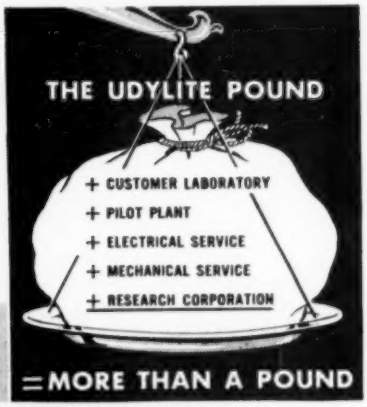


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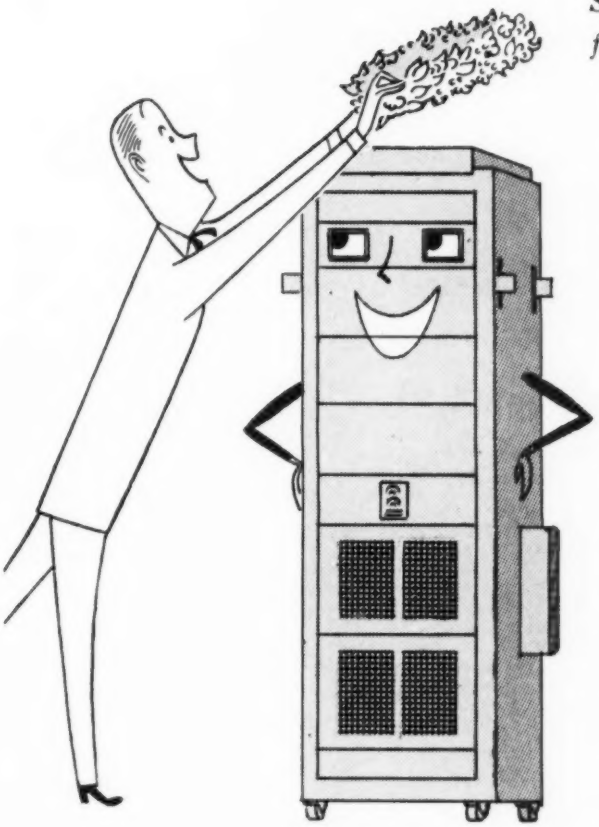

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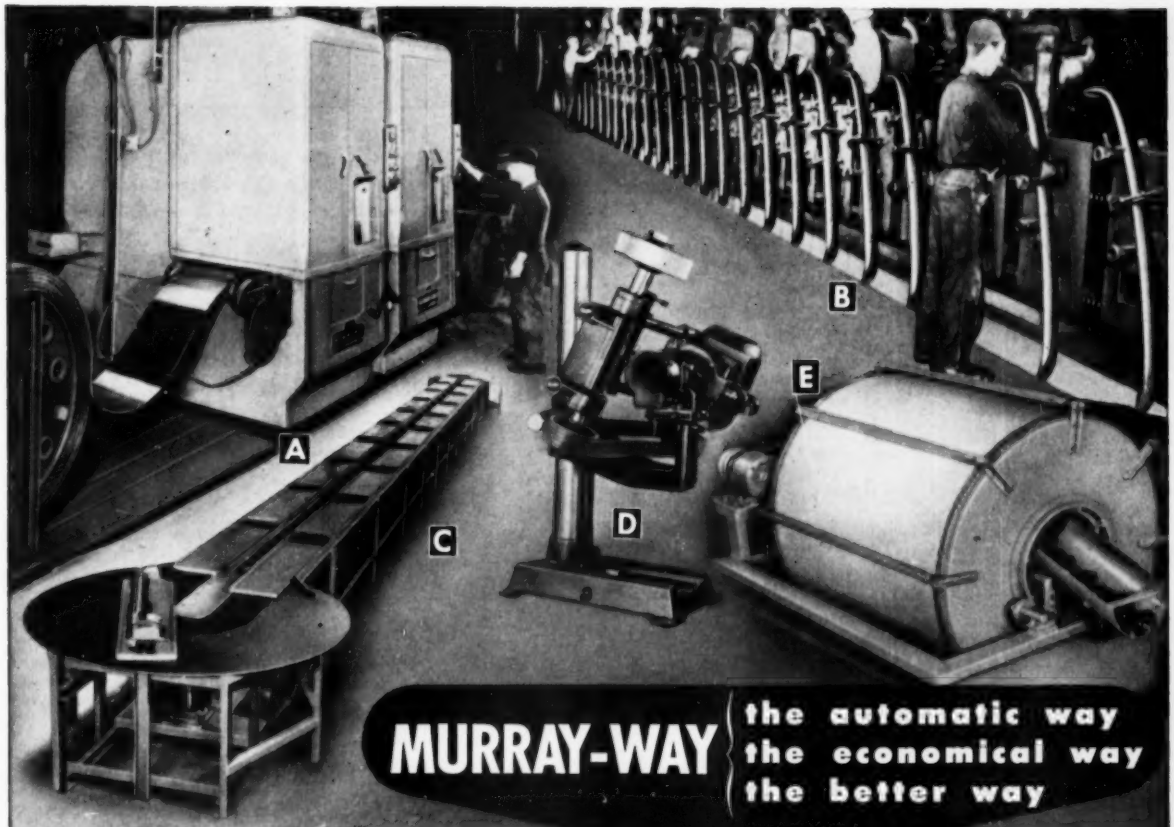


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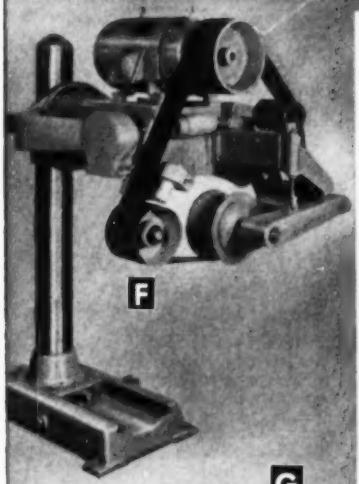

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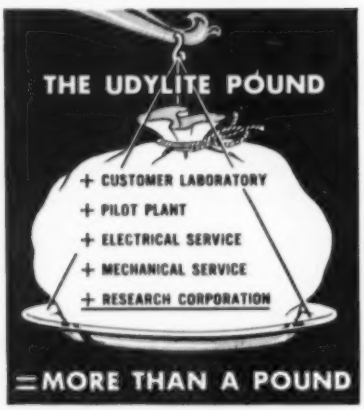


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AES Executive Board meeting Saturday, July 10, 1954 at 10:00 A. M. in the Executive Secretary's Suite at the Statler Hotel, New York, N. Y.

41st AES Annual Convention at the Hotel Statler, New York, N. Y., July 12–15, 1954.

Plating's Editorial Board meeting aboard the Hudson River steamer "Liberty Belle" on Wednesday, July 14, 1954 at 2:00 P. M.

AES Research Committee meeting at the Statler Hotel, New York, N. Y., on Wednesday, July 14, 1954 at 8:00 P. M.

Detroit Branch, AES Annual Stag Day Picnic on Saturday, July 31, 1954 at the Glenn Oaks Country Club.

Buffalo Branch, AES Annual Picnic on Saturday, August 14, 1954 at Buffalo Auto Club Grounds, Williamsville, N. Y.

Southeastern Branch, AES Annual Ladies' Night and Dinner Dance on Saturday, August 14, 1954. Place to be announced.


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